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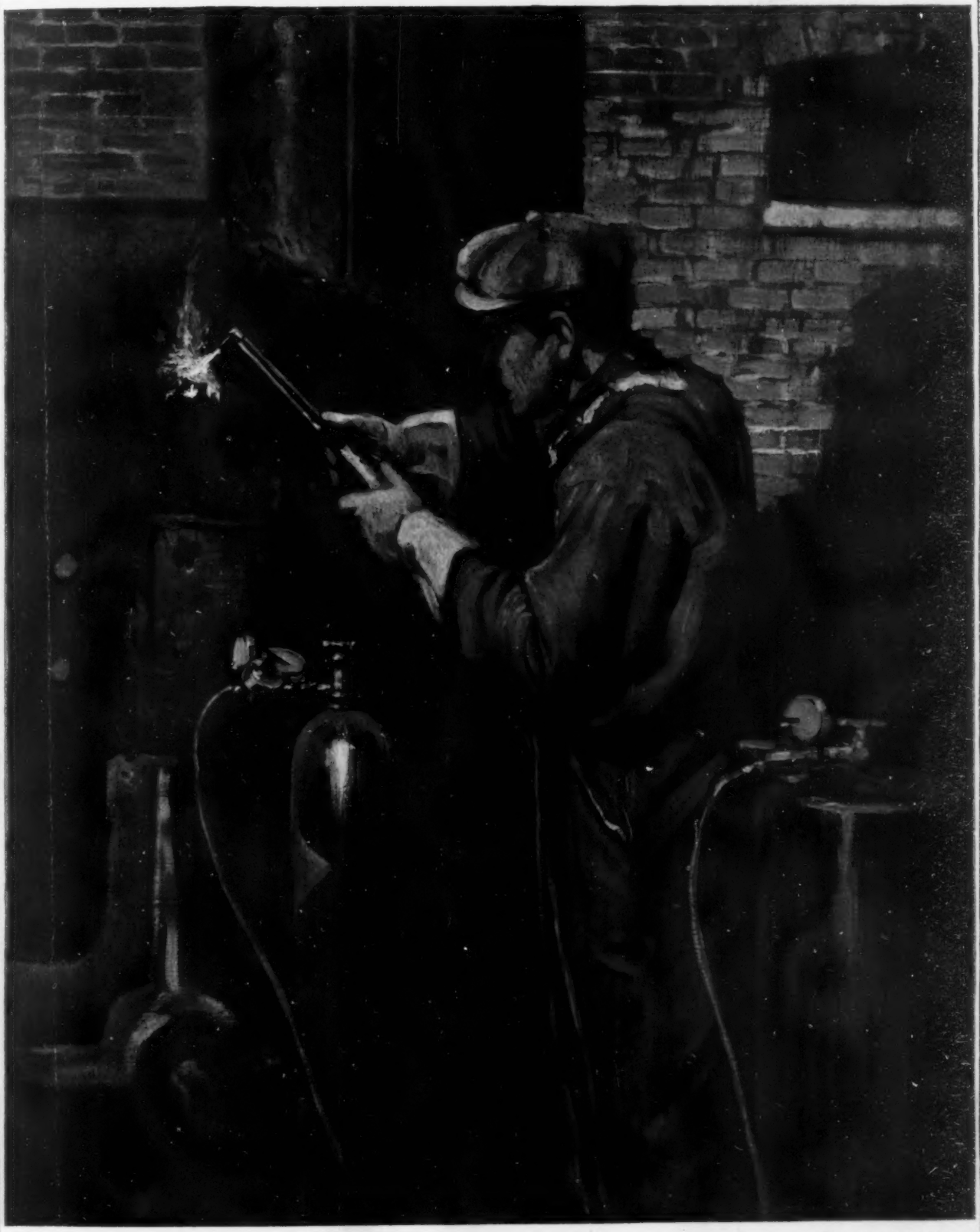


From a painting by S. J. Woolf

Vol. CX. No. 23
June 6, 1914

Munn & Co., Inc., Publishers
New York, N. Y.

Price 15 Cents
$3.00 A Year

More than all other High Grade American cars combined, selling at or more than the Cadillac price

Such is the record to date of this year's Cadillac sales

More than half of the buyers of high grade cars, investing $1975 or more, have this year shown their preference for the Cadillac.

More than half of such buyers, after carefully weighing the evidence, have decreed the Cadillac to be the car which offers the greatest value in the investment.

More than half of such buyers, after mature deliberation, have reached the conclusion that the Cadillac is the car which evidences the greatest advancement in motor car development.

More than half of such buyers have adjudged the Cadillac to be the car which provides the highest degree of comfort, luxury and convenience.

More than half of such buyers have awarded the verdict to the Cadillac as the car which affords the acme of all 'round efficiency.

More than half of such buyers believed the Cadillac to be the car which contributes most to lasting satisfaction and contentment.

More than half of such buyers were convinced that the Cadillac is the car which provides, in most abundant measure, all of those qualities which contribute to the charm of motoring.

Has ever a motor car received such overwhelming endorsement?

STYLES AND PRICES

Standard Touring Car, five passenger	$1975.00		
Seven passenger car	$2075.00	Landaulet Coupe, three passenger	$2500.00
Phaeton, four passenger	1975.00	Inside drive Limousine, five passenger	2800.00
Roadster, two passenger	1975.00	Standard Limousine, seven passenger	3250.00

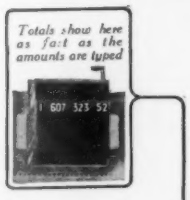
All prices are F.O.B. Detroit, including top, windshield, demountable rims and full equipment

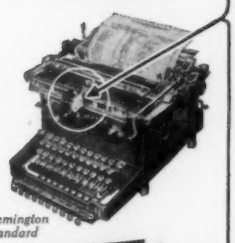
Cadillac Motor Car Co. Detroit, Mich.

Don't say, "Oh, this announcement is for my bookkeeper."

It is for *you*

It shows how you can save hours of clerical time




Remington Standard

Smith-Premier Model

Monarch Model

Without this all-around machine, your billing clerk goes through three time-consuming acts:

Act 1.—Writing the bill.

Act 2.—Footing.

Act 3.—Proving the total.

This complete correspondence typewriter does all three simultaneously. With cold steel accuracy, it automatically foots and proves your bills *while it types them.*

It soon pays for itself in this saving of clerical time alone—to say nothing of the errors prevented.

You owe yourself an early investigation.

Your first doubt will be: "Can I be sure that this machine is accurate?"

That is answered by the United States Sub-Treasury and prominent banks throughout the country, who use it constantly.

Your next, "Can I apply it to my present billing system?"

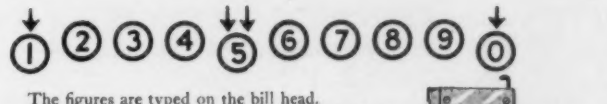
That is answered by thousands of business offices and retail stores—large and small—who are using it without the slightest change in system.

It does your work *your* way.

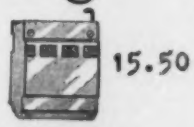
A new illustrated folder—"The Story of a Day's Work" describes the workings of this remarkable time and money saving machine. Briefly and interestingly, it points out the uses for the Remington Adding and Subtracting Typewriter—in your own store or office—on your own bills and statements. "The Story of a Day's Work" carries a really worth-while message for any employer of clerical or stenographic help—regardless of the size of his business. You would hardly want to miss it—so while you think of it—send for your copy—TODAY.

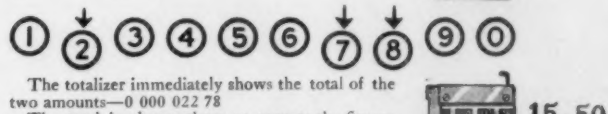
How it saves time

Take a simple case. Suppose you are typing a bill and your first item is 50 lbs. coffee @ .31—amount $15.50. When you come to the amount press 15.50

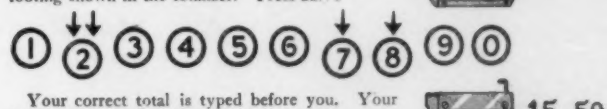


The figures are typed on the bill head.
Now look in the totalizer! Right in front of you it flashes 0 000 015 50
Now for your next item. Call it a barrel of flour @ $7.28. Type 7.28





The totalizer immediately shows the total of the two amounts—0 000 022 78
The total is always there as soon as the figures are typed.
Now touch the subtracting lever and ent r the footing shown in the totalizer. Press 22.78



Your correct total is typed before you. Your totalizer now shows 0 000 000 00
That row of cyphers *proves* that the total has been correctly entered. Not a moment has been wasted. Send today for "The Story of a Day's Work."

REMINGTON
Adding and Subtracting
TYPEWRITER
(WAHL MECHANISM)

Remington Typewriter Company, Inc., New York (*Branches Everywhere*)

For clear, clean typewriter results, use Remtico Brand letter paper, carbon paper and ribbon. Write to our nearest office.

SAXON $395

The Gasoline Toll Gate Does Not Stop You in a Saxon

Saxon owners are saved the annoyance and expense of frequent stops to pay toll at the gasoline stations. The occupants of the light but sturdy Saxon drive by in comfort while many a touring party in a big, heavy car is held up for fuel replenishment.

Thousands of owners daily find the Saxon the most economical car they ever drove; they consider it the most economical car of standard design in the world—to buy and to run.

A Year's Service in a Month

And the Saxon saves you money every day you drive it. Here are some economy records from a test made in Detroit, representing the equivalent of a year's service. Note them carefully:

135 miles a day for 30 days.
30 miles to the gallon of gasoline
200 miles to the quart of oil.
Half a cent a mile for fuel; one-fourth of a cent a mile per passenger.
All the original tires good for from 2,000 to 5,000 miles more of service.

Similar records of gasoline and tire economy are reported to us by owners and dealers all over the country. No wonder Saxon owners say: "It's cheaper to drive a Saxon than to use street cars—especially when you consider the time saved."

Not only does the Saxon give pleasure and health at moderate expense—to those who don't want to pay an extravagant price for a car; to those who already own a big car; to those who need a car for summer vacation use. ITS WONDERFUL ECONOMY IS A REASON ALSO FOR USING IT IN BUSINESS.

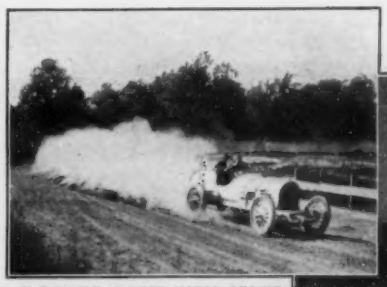
Order Your Saxon Now

Saxons are selling fast—faster than we ever dreamed they would. It must be a case of first come, first served. So the only way to avoid being one of the disappointed is to see your dealer and order now.

Catalog and dealer's name on request.

SAXON MOTOR COMPANY
Dept. F. DETROIT, MICH.

GRAFLEX CAMERAS


THE 60-MILE-AN-HOUR MOTOR, REQUIRING A SHUTTER SPEED OF 1-1000 OF A SECOND

SNAP SHOTS INDOORS, IN THE SHADE OR ON CLOUDY DAYS

The Kind of Pictures You Can Make with a Graflex Camera

AND there is no uncertainty. When you look in the focusing hood you see the image, right side up, the size it will appear in the finished picture *up to the instant of exposure.* Finder and focusing scale are done away with. There is no necessity for estimating the distance between the camera and the subject.

If you will send us your name and address we will mail you our 64-page illustrated catalog, which tells all about GRAFLEX CAMERAS and how they work. Be sure to specify *Graflex Catalog.*

FOLMER & SCHWING DIVISION
EASTMAN KODAK CO.
ROCHESTER, N. Y.

An automobile should weigh less than 3000 pounds

WHEN we say "Automobile" we mean the average type of car, the five-passenger touring car of 120-inch wheel base. That is the correct length of car for comfort. Less length is not enough. More is unnecessary.

Up to a year and a half ago all cars of this size—both four-cylinder and six-cylinder—weighed from four to five thousand pounds. Most of them still do. That's *two to two and one-half tons.*

Is such weight *reasonable?* Is it *necessary* for *safety* and *durability* and *comfort?* Some manufacturers would ask you to *think so,* but can you imagine it? Three or four years ago it *was* necessary,—not for safety or durability or comfort, but simply because no manufacturer *knew how* to build *lighter* cars and *build in* the required qualities.

The world moves. *Some* of the *people* stand still for a time, but the *world* goes on. And with the rapid development of automobiles came a parallel *demand* for *lighter weight,* just as came the demand for six-cylinder *continuous, smooth* flow of power.

The public said: "We *want* cars. We know the pleasure of the automobile. We know its utility. But we are staggered by the expense. Tires wear out so fast and they cost so much! The motor eats up so much gasoline and it costs so much! Why can't *lighter* automobiles be built, with *just* as much safety, just as much durability, just as much comfort? Why not?"

Well, *why not?* A couple of years ago *some manufacturers* began to think seriously on that question. Among them were the men who built the first Chandler Light-Weight Six a year-and-a half ago,—men who had been designing and building and selling the highest grade motor car in America for years. And for years before that, the finest bicycles.

We certainly knew motor car construction, we knew six-cylinder construction, we knew automobile engineering, we knew that the demand for light weight was logical, and we felt sure we could build a six-cylinder car of 120-inch wheel base that would possess every known degree of safety, of durability and of comfort and *not weigh more than 3000 pounds.*

How, you may ask, did we hope to cut off that fifteen hundred or two thousand pounds!

Someone suggests that light weight comes from cheap materials. Not at all. *Cheap iron* is just as heavy as *good* iron.

We were going to *cut out the iron.*

And we cut it out.

It's the people who haven't cut out the iron that are "warning" you against light weight.

We cut out the heavy castings that add weight but *not* strength to a car. And what did we use in their stead? *Aluminum,* and *pressed steel.*

Are they as strong? Ask any engineer you chance to know.

It takes two men to lift a *cast iron* crank-case. But you can put an *aluminum* crank-case under your arm and walk away with it.

Which would you rather have, the cast iron or the aluminum?

Another factor in the Chandler light weight is the use of high-grade, efficient, imported ball bearings throughout in place of the heavy friction-producing roller bearings with their heavy cases and carriers.

And so on, all through the Chandler, we cut out *weight* without sacrificing one single degree of strength.

Is it *durable?* Ask any Chandler owner. We will refer you to as many as you want, and in any part of the country you say. *Of course* the car is durable. We started with a *clean slate,*—no errors to forget, no faults to overcome, and we built it so that it *had to* endure.

Is it *safe?* A year's service has brought no report of a *break-down.* Hundreds of owners have done five to ten thousand miles without a single repair. In the Swedish Reliability Test, conducted by the Swedish Royal Automobile Society in February — over 800 miles of storm-wrecked roads that experts declared impassable—the Chandler was the only American-built entrant with no failure to finish. In all other endurance tests it has finished with honors. Do not these qualities spell safety? The Chandler gives you *100 per cent safety.*

Is it *comfortable?* We will let you answer that for yourself. The car will tell you all about comfort better than we can. Go to your Chandler dealer—there's one in every principal city in America and in hundreds of smaller cities. Go to him and say, "Prove to me that a car weighing less than 3000 pounds is as comfortable as the heavy cars. Let me pick out the roads. Drive me where I want to go. Get away from the boulevards. Take me fifty miles out through the country and *drive fast.* Hit all the bumps. Let's see if it's comfortable."

Put it up to the Chandler man just like that. Don't worry about hurting his feelings. He's *waiting* for you.

Heavy Car Builders Do Not Name Weight

You have noticed, of course, that practically all manufacturers are *talking* now about lighter weight. But it's mostly just talk. Read the advertisements, "A light car and a speedy one," "How much should an automobile weigh," "The unmistakable demand for light weight," "Our car is 300 pounds lighter," "Our light six is just the right weight," and so on and so on. A lot of fine sounding talk, but **NO FIGURES.** If they are proud of 3700 lb. weight or 4000 lbs., or 4500 lbs., why don't they *name* the weight! And have you noticed that the *only* cars whose weights are *advertised,* weigh less than *3000 lbs.?* All the others will name their weights, too, when they reach the 3000 lb. mark, *but not before.*

CHANDLER $1785

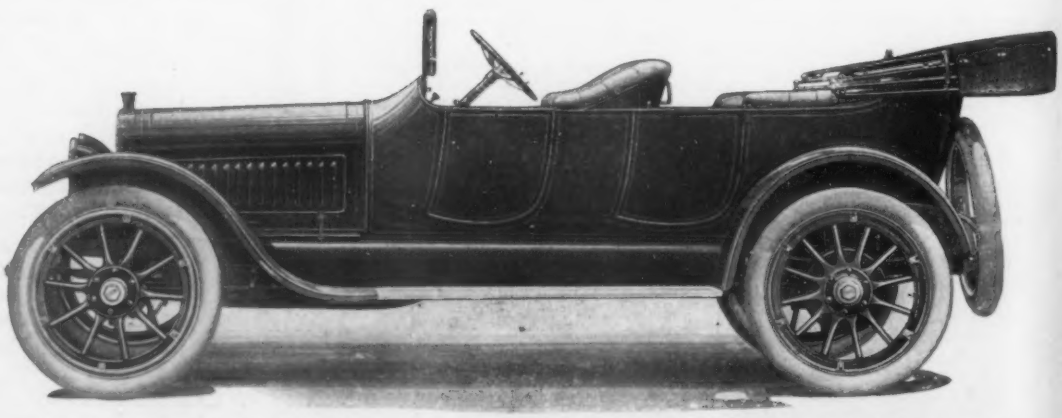
LIGHT WEIGHT SIX

Weighs 2885 pounds fully equipped
Runs 16 miles per gallon of gasoline
Averages 7000 miles per set of tires
Speed, 3 to 55 miles per hour on high gear

Remember the Bicycle!

YOU probably recall the 60-lb. bicycles. *Everybody* made them heavy, and a "century run" was an *event.* Then a pioneer who was *thinking* cut off 28 lbs. in one stroke. Built bicycles that weighed 32 lbs. Other manufacturers *warned* the public. Said light weight bikes couldn't *stand up,* and would "jolt the rider all to pieces." Within two years *all bicycles* were *light weight, lower priced,* stronger, more durable, just as *smooth-riding* as ever, and century runs were *commonplace* because of the *economy in power.*

History is repeating itself.



Write today for Catalogue and a convincing experience book called "Bouquets"

CHANDLER MOTOR CAR CO., 906-936 E. 131st Street, CLEVELAND, OHIO

SEVENTIETH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CX. NUMBER 23.

NEW YORK, JUNE 6, 1914.

15 CENTS A COPY
$3.00 A YEAR

Threatening to engulf a cottage.

The ice piled itself up in huge billows.

An Ice Flood

By W. F. Anderson

ON the afternoon of Easter Sunday there occurred at Sylvan Beach, N. Y., on the shore of Oneida Lake, a very sudden transfiguration of the scenery, as will be observed from the photographs shown. A field of ice came up out of the lake like a tidal wave and piled itself in huge billows upon the shore.

The ice on the lake averaged about 12 inches in thickness and was melted along the shore for a distance, on the average, of about a hundred feet out. At this particular time a severe gale began blowing and moved the ice shoreward with such force, that, from the momentum gained, it was forced out upon the beach and over the concrete sea-wall. In some places the sea-wall was entirely wrecked. The ice continued to pile up till, within a period of twenty minutes, it had reached a height of thirty feet in places, and reached along the entire length of the southeast shore of the lake.

One picture shows the ice piled on top of the roof of the front porch of a cottage. This cottage was practically demolished and the whole interior was filled with ice. There was no way of combating this glacial flow.

Old inhabitants of this vicinity claim that a phenomenon such as this has not been seen here for over twenty-five years.

In some places the concrete sea-wall was wrecked.

The ice billows reached a height of thirty feet.

How It Feels to Travel by Flying Boat

AN admirer of, and occasional contributor to the SCIENTIFIC AMERICAN, recently made a flight as passenger in a Thomas flying boat, which has been located at Dobbs Ferry, on the Hudson River, for the past few weeks, doing "missionary work" in the cause of aviation. A first flight is always interesting, and an invitation from the manager, F. Rodriguez, to make such a flight with Ralph M. Brown, was quickly accepted. Upon the advice of the preceding passenger, the writer stuffed cotton in his ears first. Slipping on the airman's padded jacket, he stepped aboard the boat at the bow just after Brown had beached her and opened the hinged doors forming the deck of the bow, by pulling a lever. He found a comfortable seat beside the aviator, with plenty of room to stretch his legs. The big 6-cylinder Austro-Daimler up above, between the planes, was running slowly. Two men in hip-boots pushed off the boat and swung it around until it could be steered out into the river. The big engine stopped sputtering and emitted a steady roar. Instantly the boat scooted over the water diagonally across the Hudson. It tore along at 60-mile speed until it "bumped the bumps" on the waves of a passing steamboat. Then perfectly smooth motion and no more spray drew one's attention to the fact that it had left the water and was ascending along a gradual incline. The waves soon appeared to be ripples, and the steamboat a toy craft, as the aeroplane circled around her at a height of 500 feet. Brown let the machine tip naturally, and the angle it assumed was such as to make one feel uncomfortable and fearful of side slipping, although the inclination was scarcely any more, perhaps, than a train tips when rounding an extremely sharp curve.

Once on the straightway up the river, one had a chance to glance to one side or the other and view the beautiful grounds of the country places, appearing like models of landscape gardens, one tenth of a mile below.

At the 70 miles an hour at which we were flying the wind pressure was so strong, however, that if one turned one's head ever so slightly the pressure on the foremost ear was decidedly uncomfortable. Even with cotton in the ears, the roar of the air by them was almost sufficient to drown the exhaust of the motor. Tears formed in the eyes, but were quickly blown aside. When provided with goggles and a skull cap, flying at high speed must be delightful and exhilarating. An automatic stabilizer will eliminate steep tipping at the turns and a celluloid windshield the strong air pressure. Flying above water at a low elevation is quite as safe as motoring and much more pleasurable, and the reason for the popularity of the flying-boat ferries that have been started in the South and West is easily seen. For the business man who commutes a distance of 50 to 75 miles, a flying-boat will more than pay for itself in health and pleasure derived in a single season.

A Remarkable Collection of Human Embryos is being made at Johns Hopkins University under the direction of Prof. Franklin P. Mall, whose private collection constituted the nucleus of the new one. Circulars distributed to physicians throughout the United States and abroad have resulted in the addition of about 150 specimens within six months, many of them unique. Special care has been taken to secure accurate histories of this material. Series of specimens from the collection are lent for study to persons engaged in working out special problems in embryology, and important investigations are also being carried on by Prof. Mall and his assistants.

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Founded 1845

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Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Lost Through Insufficient Subdivision

THE loss of the "Titanic" with 1,500 souls was due, as we showed at the time, to insufficient subdivision. The rupture of the outer skin permitted the water to fill the ship from side to side, in the compartments affected. An inner skin, laid upon the frames, or in the form of the inner wall of coal bunkers built along the sides of the ship, would have kept her afloat long enough for all the passengers to be saved by rescuing ships.

Since that disaster, the "Olympic," sister to the "Titanic," has been made a safe ship, by the construction of an inner watertight skin some three feet in from the outer shell of the ship.

The ill-fated "Empress of Ireland," which was sunk in the St. Lawrence, on the 29th of May, with the loss of nearly one thousand souls, as the result of being rammed by a collier, was built under the same faulty Board of Trade rules under which the "Titanic" was built. She was provided with nine transverse bulkheads; but she possessed no side longitudinal bulkheads, nor had she any inner skin. When she was pierced by the bow of the collier, the water was free to fill the 65½-foot width of the compartments affected. The inrush of water was so rapid that the ship began at once to list heavily, and *in fourteen minutes this 20,000-ton ship had capsized and gone to the bottom!*

It so happens that we publish, in this issue, the plans of a ship, the "Aquitania," which makes her maiden voyage to New York this week, whose construction, with side bunkers, is such that she could have sustained the blow of the collier "Storstad" without being sunk, and indeed without any serious risk of being sunk. The moment the stem of the collier touched the side of the "Empress of Ireland," it was twisted aside, and the bow was so greatly blunted that it would never (had the ship been the "Aquitania") have crushed through the eighteen feet of coal in the bunkers and reached the inner skin.

In the presence of this ghastly repetition of the "Titanic" disaster let us keep our eyes on the big facts. These hapless people (nigh a thousand of them) were drowned because the ship was not built *unsinkable*—and it is perfectly possible to build ships so well subdivided that they cannot be sunk—certainly not in fourteen minutes—by collision. The "Empress of Ireland," like the "Titanic," was a safe ship, judged by the British Board of Trade requirements as to safety. But at the time of her construction the safety requirements of the British Board of Trade were ridiculously inadequate. They allowed a ship to fill two adjoining compartments and bring the top of her bulkheads to within a foot or two of the water, and pronounced her safe when in that condition. Whether the "Empress of Ireland" filled more than two compartments we do not know at the present writing; but we do know that it took just fourteen minutes to send her to the bottom.

The big thing to remember in the investigation of this disaster is that the one sure protection for a ship against sinking is an inner skin—the ship within a ship. The naval constructors have adopted this protection for battleships against the ram and torpedo, and they ought to know.

It is a matter for deep regret that the great International Conference which sat for several months, last winter, in London, did not make the provision of an inner skin obligatory. They left it to the judgment of the individual companies and their naval architects.

The findings of this Conference await ratification by our Senate. We strongly urge that, in view of the recent disaster, our Government should incorporate a clause making some form of inner skin obligatory on all ships carrying more than a certain number of passengers.

The Regulation of Harbor Traffic

THE growth of population, with its corresponding increase in the density of traffic in our large cities, has led to the organization of "traffic squads," whose sole duty it is so to regulate the movement of vehicles through the streets, particularly at congested points, that it shall proceed with the least possible interruption and in the greatest possible volume. Residents of our largest cities will remember how the unregulated traffic would frequently become so completely tangled up as to come to an absolute standstill, and require many minutes to loosen out the congestion and set the mass of vehicles in motion again.

We borrowed the idea of a specially organized street traffic police force from abroad, and it has worked so well in this city, that such a thing as an absolute deadlock in traffic, even at the most congested centers, is now practically unknown.

When we come to consider the question of river and harbor traffic, we find that like causes have produced like results. Of course, there is at present nothing comparable to the confusion and absolute deadlock that formerly occurred on our city streets; nevertheless there is a feeling among shipping men that the time has come for introducing some form of authoritative regulation of the movements of shipping, in order to prevent delay, avoid accidents, and get the maximum traffic efficiency out of the more crowded waterways of our leading ports and harbors.

Not many weeks ago, we had occasion, in these columns, to comment upon a serious accident to one of our ferryboats in the North River, which, as we pointed out, was due to lack of stringent laws protecting the navigation of these boats. The trouble, however, does not come from them; for, as a rule, our ferryboats are superbly handled. Indeed, when we remember that their courses lie largely across the track of shipping in one of the busiest ports in the world, it must be admitted that the work of the ferryboat captains is well done.

The chief obstruction and delay comes from the lighters and other slow-moving traffic. During the period of heavy ebb and flow of the tide, the current is so strong that the handling of heavy loads is extremely difficult, and often the tows are brought practically to a standstill, in which case they become a most serious impediment in the handling of large ships in the river. A notable instance of this occurred in the recent docking of the "Imperator," which, after she was straightened out across a rather strong ebb tide, and was about to enter her dock, found the entrance completely blocked by a tug which was vainly endeavoring to push its heavy tow upstream against the current. The big ship had to drop downstream, with the result that it was some hours before she was finally moored in her berth. Such incidents are liable to occur at any time when the large modern liners are making their piers. There is a feeling among shipping men that the time has come for the appointment at this port of a Harbor Master, who, with his staff, shall serve the purpose of a traffic squad in the North and East Rivers. The large ports of Europe are controlled in this way, and experience has proved that thereby the speedy and safe handling of shipping is greatly facilitated.

Problem of the Permanent Road

FOR many years the management and the engineering staff of our railroads have well understood that the provision of an absolutely first-class roadbed and track, in respect alike of its construction, grades and curvature, was most intimately related to the question of profitable operation; and it is with a clear recognition of this fact that our larger railroad systems have expended during the past two decades hundreds of millions of dollars in cutting out curvature, reducing grades, strengthening bridges, and increasing the weight of rails and fastenings.

There is to-day a growing appreciation of the fact that the same economic conditions apply to the construction and maintenance of the country's highways. Here the matter of grades is not of such vital importance; but the importance of providing a solid and well-founded roadbed, properly drained, and provided with a top surface of such a durable character that it will preserve a true and solid surface for a long period of years, is receiving the fullest recognition. It is coming to be understood that the question of first cost has been given undue importance; we now know that the extra initial expense of an absolutely first-class and durable road, that is subject to heavy traffic, is more than compensated by the elimination of costly repairs, and of the great loss (an item which has received too little consideration in the past) due to the long periods of time during which the road is out of service because of repairs.

A few weeks ago, we had occasion to refer to a report of Governor Glynn of this State, in which he showed that there would be an enormous saving of cost over the present macadam roads, with their limited life and their exceedingly costly repair bills, if they were built with a brick surface upon a well-constructed foundation. In this report the Governor states that in New York a mile of macadam costing $12,000 does not last over ten years, and that its maintenance would cost about $1,000 a year, with the result that at the end of ten years the road must be rebuilt at a cost for reconstruction of $6,000 a mile. The total expenditure for twenty years on a mile of macadam road therefore amounts to $36,000, including $12,000 for building, $18,000 for maintenance, and $6,000 for rebuilding at the end of the first ten years. As against this the report pointed out that the total expenditure for ten years on a vitrified brick road would amount to $26,000 only, estimated at a maximum of $25,000 for building and a maximum figure of $50 a year for maintenance.

We find a verification of this report in an address given by Mr. Will P. Blair, at the first Canadian and International Good Roads Congress at Montreal held last May, the subject of the address being the economy of a vitrified brick road. The author lays stress upon the fact that the greatest element in fixing the economy of any road is the very one which is least taken into account; namely, its out-of-repair condition. On many types of road, break-down of the surface is so frequent as to call for almost complete reconstruction; and at such times a stretch of road may be put entirely out of commission. The sum of the periods of times that the road is out of actual service, coupled with the smaller loads that can be hauled over an inferior road, the broken springs, the extra wear and tear of the vehicles, etc., if converted into dollars, might equal, in a surprisingly short period of time, the entire original cost of the improvement.

The author of the paper gives some useful facts as to the experience already had with brick roads in this country. It seems that the main streets of Belleville, East St. Louis, Alton, and Danville in Illinois; of Terre Haute, Richmond, Frankford, and Lebanon in Indiana; and of Portsmouth, Chillicothe, Sandusky, and Conneaut, Ohio, are brick paved. All of these streets, he stated, have more than an average life of twenty years. In Cleveland and other large cities, many streets have brick pavements whose average life exceeds twelve years. Moreover, there are hundreds of streets paved with brick to be found throughout the above-mentioned towns which have been in use over ten years, all of which have not called for a penny of repair work due to wear and tear. The significance of these facts will be evident when it is borne in mind that the average traffic upon these streets is at least twice that of any traffic that is borne upon any part of the country highways of the main market or interurban systems.

Form and Substance

CHANGE is the order of Nature. Yet, in the ever-shifting landscape of the world's events, we have learnt to distinguish two stable landmarks, *Matter* and *Energy*. The recognition of this constancy represents, to the physicist, one of the great central truths of science. But from a more "human" point of view, there is something unsatisfying about this permanence of substance. For what counts, in life, is not the substance, but the form. And the form is fleeting, though the substance abide. What if the changing seasons leave the total mass and energy of the universe unaltered? Spring brings its buds and blossoms, Summer ripens, Autumn gathers in the fruit. These are the things that matter. What comfort, when the living form is fled, that the total substance be unaltered? Life is one ceaseless endeavor to preserve a form, an effort in which sooner or later all are vanquished.

Yet, for a time the organism does succeed in preserving that characteristic form on which its life, its consciousness depend. And, strangely enough, here, in a sense, conditions seem reversed: while the form is constant, the substance is forever changing. The human body, for example, might be likened to a house, the bricks of which were continually being removed and replaced by others, in such way that the form of the building be carefully preserved. The life of man, his very identity, depend, not on the bricks of which he is built (for they are replaced from day to day), but on the form in which his structure is raised. And this constancy of form, which for a time is his, unlike the constancy of mass, is not inherent in the nature of things, but must be purchased by continued effort. And sooner or later the effort fails, and that form which means all to the organism crumbles and decays.

As if by an irony of fate, while Nature has guaranteed the permanence of substance, at any rate for æons to come, the very things by which we set most store depend on form, fleeting, evanescent.

Electricity

Buying Current for Electric Railways.—At a recent meeting of the Illinois Electric Railway Association in Chicago, Mr. Peter Junkersfeld gave an address on power production for electric railways, in which he brought out the fact that while in 1902 electric railways purchased very little power, ten years later 33 per cent of all the power used was purchased. Illinois, in 1912, purchased electricity amounting to 58 per cent, while in Chicago, during the first few months of the present year, surface and elevated railways used 90 per cent of purchased electrical energy. This shows that electric service companies, by producing in large quantities and specializing, are able to furnish electricity cheaper than the railways can manufacture it for themselves.

New Lights for Turin.—The city of Turin is occupied with the task of reorganizing the public lighting on a modern basis, and no less than $400,000 will be employed for this purpose, the work to be carried out from 1914 to 1916. According to the plans, arc lamps will be used in all the main streets and avenues, also the public squares, while smaller streets are to be lighted by incandescent lamps. Flaming arcs in closed globes will be used. About 3,000 lamps of 2,000 candle-power each will be installed. In some places, incandescent lamps are used, some being of the 500 candle-power type, and the rest of 100 or 200 candle-power. These are much better than the present gas lamps, which give only 50 candle-power. Current for the whole system comes from the municipal electric station.

Hydro-Electric Plant for Washington.—A bill has been introduced in the Senate providing for the development of electric power from the Potomac River at Washington. According to the plan, the Potomac River is to be dammed at the Chain Bridge, just above Washington. The dam is to be 115 feet high, and would make a lake 9 miles long, extending as far as Great Falls, where the city now obtains its water supply. The plant would develop 99,000 horse-power. The Government now uses a steam plant producing 10,000 horse-power, and about 1,000 horse-power more is bought from an electric power company. With its own power plant, the Government could obtain all the electricity it needed at a much lower cost, and would have, in addition, plenty of current to sell at a low rate to railways and factories.

First Prosecution for Violation of Wireless Laws.—A wireless amateur of Los Angeles was reported to the United States Attorney for operating his station without a license, and causing interference, being a violation of Section 1 of the Act of August 13th, 1912, to regulate radio communication, for which a penalty of $500 is provided and the apparatus may be confiscated, in the discretion of the court. Judge Wellborn, of Los Angeles, in passing sentence upon the offender, stated that as this was the first prosecution under the law in his district, he would assess only a nominal fine, with the understanding that all future prosecutions under this Act would be dealt with summarily, and the punishment materially increased. In view of the fact that the offender had disposed of his radio apparatus shortly before his indictment, the judgment did not include the confiscation provided by law.

Look Out for the Wires!—The New Haven Railroad has issued a warning to all persons along the line of its present electrical extension, notifying them, and particularly the small boy, that the wires are soon to be charged. As a voltage of 11,000 is to be used, the wires are certainly not to be meddled with. At different points along the line there are circuit-breakers where sections of the road can be de-energized. In case of a fire where a stream of water might be directed against the wires, or any other emergency, word would be sent to the Cos Cob power house, and in five minutes that section of the line would be de-energized. While no harm can come merely from the spray occasioned by squirting at a fire, it would certainly be careless for the firemen to direct a stream full at the wires. About two thousand "Live Wires," "Danger" and "Keep Off" signs have been installed along the line.

The Most Powerful Magnet.—Probably the strongest electromagnet is produced on the new method which Profs. Perot and Deslandres are applying, with success. Their idea is to take one of the strong electromagnets of laboratory type with pointed pole-pieces which already give a high value of the magnetic field, and then to put an extra coil around the air-gap between the poles so as to add considerably to the field. Such coil is made of thin copper strip and is cooled down as low as —30 deg. Cent. by a current of oil, so that a remarkably heavy current can be put into the coil without burning it; for instance, it will stand a current density of 1,800 amperes per square millimeter, using a 0.2 millimeter strip. Such a coil is put on a Weiss electromagnet which carries the usual coils and gives 41,000 gauss for the magnetic field strength. Putting on the 30,000 ampere-turns of the new coil, this brought the field strength up to 51,000 gauss, and it was only lack of current supply that prevented running as high as probably 60,000 gauss, so that a most powerful field can be thus obtained.

Science

A Fine Collection of Meteorites has been acquired by the American Museum of Natural History, in New York, through the generosity of Mr. J. P. Morgan. This comprises the entire stock of meteorites which belonged to the unique establishment in Washington known as "Howell's Microcosm" at the time of Mr. Howell's death, and includes representatives of 54 falls, weighing in the aggregate about 220 pounds.

The Association of American Geographers at its last annual meeting adopted a plan of co-operation with the American Geographical Society, in accordance with which a joint research committee of the two organizations is to administer a joint research fund; a joint meeting of the two organizations is to be held in New York each Spring; the Association is to publish its annals in collaboration with the Society, and the two organizations will interchange publications.

Explorations North of Siberia will be resumed this Summer by Capt. (late Lieut.) Vilkitskii, who discovered last Summer a large and previously unknown land north of Cape Chelyuskin. He will have under his command the same vessels as last year, the "Taimyr" and "Vaigach," both of which are ice-breakers. The best of the several maps thus far published of Vilkitskii's discoveries appears in the April, 1914, number of *Petermanns Mitteilungen*.

Sir Ernest Shackleton, accompanied by five members of his prospective Antarctic expedition, will shortly make a practice trip over the Norwegian glaciers, in order to test under polar conditions his rations, tents, motor-sledges, and other items of outfit. The party will live on regular sledging rations, and the effects of these on the explorers will be carefully studied. The dogs which Shackleton will take with him to the Antarctic have been especially bred in arctic Canada, and are a cross between a wolf and a Scotch staghound. They are about twice as heavy as those which he used in his last expedition.

Arsenic in Carpets.—Arsenic in certain carpets was found to be the cause of hitherto undiscovered maladies in various cases noted by the German scientist, Dr. Küttner. It may appear singular that the presence of carpets should be detrimental to the health, but he observed five cases with distinct symptoms of anæmia and the like, and these disappeared when the carpets were removed. He surmised from the color that the carpets might contain arsenic, and when they were analyzed this was found to be true, and in a considerable proportion. Traces of arsenic were also found in the bodies of the persons.

The Proposed Swedish Antarctic Expedition has now, as appears from a detailed statement of its plans in the *Geographical Journal*, expanded into an "Anglo-Swedish" expedition. Funds toward the support of the enterprise are being raised in England. The trustees of the British Museum have promised an annual grant of $2,500 for five years, and the Royal Society has granted $2,500 for the first year. Two places on the staff of the expedition are to be reserved for English scientists, and the collections are to be divided between English and Swedish museums. It is planned to have the expedition leave Europe in August, 1915, and return in February, 1920.

The Members of the Staff of Mount Rose Observatory, Nevada, have found shellac to be an impervious and pliable water-proofing for rubbers, which otherwise during a day's use on the snow-fields absorb sufficient moisture from the snow to dampen the feet. An application of the shellac at infrequent intervals kept the rubbers in perfect condition. It was also found that a coating of shellac on the thongs of snowshoes prevented them from becoming quickly water-soaked on wet snow, and so eliminated much of the sagging and heaviness that form a serious drawback to walking on webbed snowshoes over melting snow. Thongs coated with shellac also dried after becoming wet much more quickly than thongs uncoated.

The Tides of Hudson Bay were discussed by Dr. Bell Dawson in a recent lecture before the Royal Astronomical Society of Canada. This subject is becoming of much practical interest, in view of the increasing use of Hudson Bay as a highway of commerce, but comparatively few actual observations have been made. The most important were those of Ashe, Stupart, Tyrell, McKenzie and others in 1884–86, in various shallow regions of the bay and in Hudson Strait. From these observations, the types and ranges of the tides are known at various present and prospective ports, and by selecting a port in some other part of the world for which the type is similar and for which accurate tide-tables exist, it is possible to compute tables for any desired port. By this method, Dr. Dawson has computed tables for Port Nelson, using the tables for Bremerhaven, Germany, as a standard—both places having tides of the estuary type, and the North Sea and Hudson Bay being similar offshoots of the North Atlantic. In the same way, the tide-tables of Harwich, Eng., have been used in the computations for Churchill; while the tides of St. John, N. B., have been harmonized with those of Hudson Strait observed in 1884–86.

Aeronautics

Gyratory Control in Flying Machines.—Patent No. 1,096,045, to Gustav Mees, of Charlottenburg, Germany, is for a flying machine in which use is made of a steering lifting propeller combined with a fly-wheel acting as a gyratory body.

The Aerodynamic Institute of Koutchino, in Russia, celebrated its tenth birthday on May 10th. This institution was founded by its present director, M. Riabouchinsky, and has made notable contributions to the development of aeronautics.

An Armored Aerial Machine.—Paul Daimler, of Cannstatt, Germany, has patented an armored aerial machine, No. 1,095,711, in which aim may be taken and a projectile fired in the direction of the propeller shaft without hindrance from or interference with the propeller.

A Bomb to Destroy Aircraft.—A patent, No. 1,092,760, to Joseph A. Steinmetz of Philadelphia, Pa., furnishes means for destroying an airship by another higher ship through the aid of a drag line carried by the higher ship and suspending a bomb which is exploded by being drawn upward alongside of and against the lower ship.

A Flying Machine Control Device.—William B. Oliver, of Collingswood, N. J., in a patent, No. 1,096,263, provides means whereby he seeks to automatically maintain the normal equilibrium of a flying machine in a predetermined position or series of positions during flight, thus relieving the aviator from the necessity of constantly manipulating the regulating devices.

The Wright Licenses.—According to the daily press, Orville Wright and the directors of the Wright Company recently met in New York city to discuss the terms upon which fliers and builders of aeroplanes may use the Wright inventions. In order to discourage bad workmanship, it is stated that only responsible firms will be licensed.

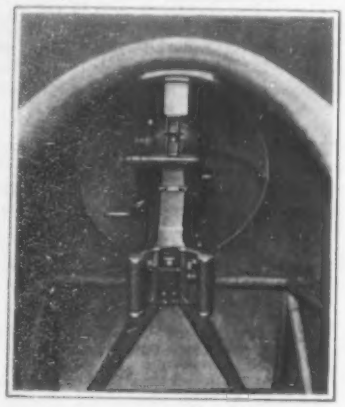
Using a Parachute for Elevating the Machine.—In a patent, No. 1,093,788, V. A. Lamare, of Chicago, Ill., assignor of one half to Linwood F. Jordan, of Portland, Me., shows a series of parachute reciprocating vertically in the frame of a machine with the upward and downward movement of the parachutes alternating to cause the ascent of the machine.

A Series of Flying Machine Patents.—James S. Lang, of Boston, Mass., has secured patents Nos. 1,096,251 to 1,096,256, inclusive, the first four patents relating to gyroscopic controlling elements and some of the patents refer to the engine itself as the gyroscopic power, while patent No. 1,096,255 provides auxiliary planes at opposite sides of the machine and co-operating with the main plane for effecting a lateral control by varying the lifting efficiency of the main plane, and patent No. 1,096,256 provides a special construction of one of the planes.

Military Aviation in the United States.—The United States Government intends to strengthen the aeronautical branch of the Army. It is reported that an order for thirty aeroplanes has either actually been given, or will be given. According to Secretary of War Garrison, the army needs fliers badly. The United States has made no systematic effort either to upbuild an air fleet at all comparable with the air fleets of Europe, or to train an aeronautic personnel. The army aviation schools turn out but very few men.

Aviation in Japan.—Capt. Tokugawa of the Japanese army, and an old pupil of Farman, has published an interesting article on the progress of aviation in his country. For several centuries, the art of traveling in the air has been known to the Japanese, he claims. In 1702, an ingenious bandit named Kakinoki Kinsuke invented an apparatus by means of which he was enabled to attain the roof of a building in Nagoya and rob it of certain gold ornaments. As in Europe, aviation has become strictly military in Japan; the 25 aviators of Japan all belong to the army, which, up to the present, only possesses 15 aeroplanes, nearly all of which are of the Farman type. Capt. Tokugawa remarks that at small distances from the ground in Japan dangerous currents are constantly circulating, a fact which compels the Japanese aviators to fly always at a good height.

New Military Aeroplanes.—At the military aerodrome of Doeberitz, Germany, trials are soon to be made with a mitrailleuse mounted on an aeroplane by the use of a turntable base so as to point the gun in all directions. A special device is said to be employed so as to prevent the screw from being damaged by a projectile. The bottom of the aeroplane can also be opened up so as to allow of firing downward upon the ground. On the other hand, we learn that the Admiralty has lately made very successful tests of a new hydro-aeroplane constructed by the Samuel White establishment. When carrying full load the speed was 75 miles an hour and it could rise from the water to 1,000 feet height in 2½ minutes. The flier is fitted with a Salmson motor of 200 horse-power size. During the recent elimination flights which served to select fliers for the Swiss army, three types of aeroplane were qualified, namely, a Blériot and two German makes.

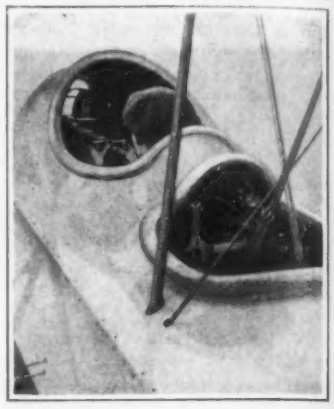


How the gun in the Vickers machine looks to the gunner.

Novelties in Aeroplane Design

A Sixty-Mile-an-Hour Gun-Carrying Biplane of Steel

A Flying Machine Which is a Mechanical Equivalent of a Soaring Bird



The gunner in the Vickers machine sits in front of the pilot.

A Gun-carrying Biplane

By Major H. Bannerman-Phillips

UP to the present progress in aeronautics, from the military point of view, has been directed mainly toward obtaining the best possible method of aerial transport for purposes of reconnaissance, although the question of offense, by means of guns and dropped projectiles, has not been lost sight of, and many experiments have been made with both airships and aeroplanes, though with results which can hardly be called conclusive, in so far as they concern fighting in the air between aircraft. There are many who still hold that the business of the latter is scouting, and that, for the present at any rate, speed is more essential than ability to attack, since the fast light scout will have the advantage of the armed machine, which, having to carry a gunner besides guns and ammunition, is bound to be heavy and slow in pursuit, and will not be able to get within range of the fugitive, the single occupant of which will obtain all the information which it is possible for an overhead observer to get, in spite of threatened opposition.

Others again hold that the opposition of the fighting aeroplane will be effective to prevent other aircraft from prosecuting a successful reconnaissance, and that, if information is to be obtained, it will have to be fought for in the air.

The fighting aeroplane is being evolved to suit the latter view, and, although we have nothing definite, in the way of past experience, to go upon, it is none the less interesting to watch the evolution of the avowedly militant types of aircraft which are now being built, and which are especially designed to carry a gun, and one of these is the Vickers fighting biplane, which is shown in the accompanying illustrations. It is designed for weight carrying and for a variable speed of from 40 to 70 miles per hour. The machine, so far as tests show up to date, has flown at speeds varying between 45 and 66 miles per hour. Messrs. Vickers, Limited, as a large armament firm, have every reason to know the value of steel in construction, and they have used it throughout in building this biplane, except as regards the main wing spars and two wooden struts in the landing carriage, the reason for this being that, although wood is not actually more elastic than steel, it will, in practice, bend to a greater extent and spring back again, without acquiring a permanent "set." In the later type of this machine, stabilizing flaps are used on the wings, instead of warping the whole wing. The gun is a small Vickers automatic gun, covered in front by a hemispherical shield, which is mounted on the barrel and moves with it. The shield is provided with mica windows, to protect the gunner's eye from the draught of wind caused by the rapid movement of the machine through the air. The muzzle projects through the nose of the fuselage, which itself is entirely covered in, and is carried well forward of the wings. Those who understand the handling of such a gun will appreciate the fact that this is an ideal position for it, affording the utmost obtainable range of view and facility for traversing right and left, and for elevation and depression. This gun-position, of course, involves the necessity for the biplane itself to be of the "pusher" and not of the "tractor" type.

The new Vickers gun-carrying biplane.

The requirements of the British military authorities are complied with, namely, that the machine gun shall have a clear field of fire in every direction up to 30 degrees from the line of flight, or, in other words, that the man behind the gun should be able to fire directly ahead within an arc of 60 degrees.

Analytical Comparison of the Bird and Monoplane

By James F. Blanchard, D.O., M.D.

FROM the dawn of time man's greatest desire has been to follow the birds through space; but not until the present gasoline motor made its appearance has that longing been realized.

If the minds that developed these wonderful machines which carry us through the air like the birds had kept away from the box-kite idea and followed more closely the anatomy of our feathered friends, the writer (who, by the way, is a physician, but one who has spent considerable time along mechanical lines) believes that more rapid progress would have been made in both pleasure and commercial air-craft.

His interest was greatly stimulated along these lines while spending a winter in Florida, several years ago. The birds of that part particularly interested him, and from these came his inspiration to build more closely along Nature's lines. The gull furnished him with the thought for the water plane, and the buzzard the idea of the land craft. His experience with the anatomy and physiology of these creatures he applied to his experiment, and the results were very gratifying.

After months of exhaustive investigation it was found that the structure of the present-day machines was weak and contrary to the laws of Nature as represented by the original denizens of the air.

It was plain to see that the mechanical bird, to be a success, must be a duplicate of Nature's air-craft, and in order that success shall be obtained, the principles of physiology and anatomy must be applied to this structure.

Pressed steel in suitable form is substituted for the bony structure of the bird. This forms the fuselage, rear appendages, main planes, and landing chassis. Trussing of light steel-tubing and laminated wood give a fine substitute for muscles, tendons, and ligaments. Fireproof cloth, sheet steel, and aluminium take the place of skin and feathers. The motor and radiator are substituted for heart and lungs; water, gasoline, and the oiling system for the lymphatics and vascular system; steering-wheel and controls for the nervous system. The special senses are represented by searchlights, wireless, and an efficient aviator. The flexor surfaces of the wings and tail-appendages are strengthened proportionally to extensor surface, according to the functions they have to perform. In this construction, strength and lightness are

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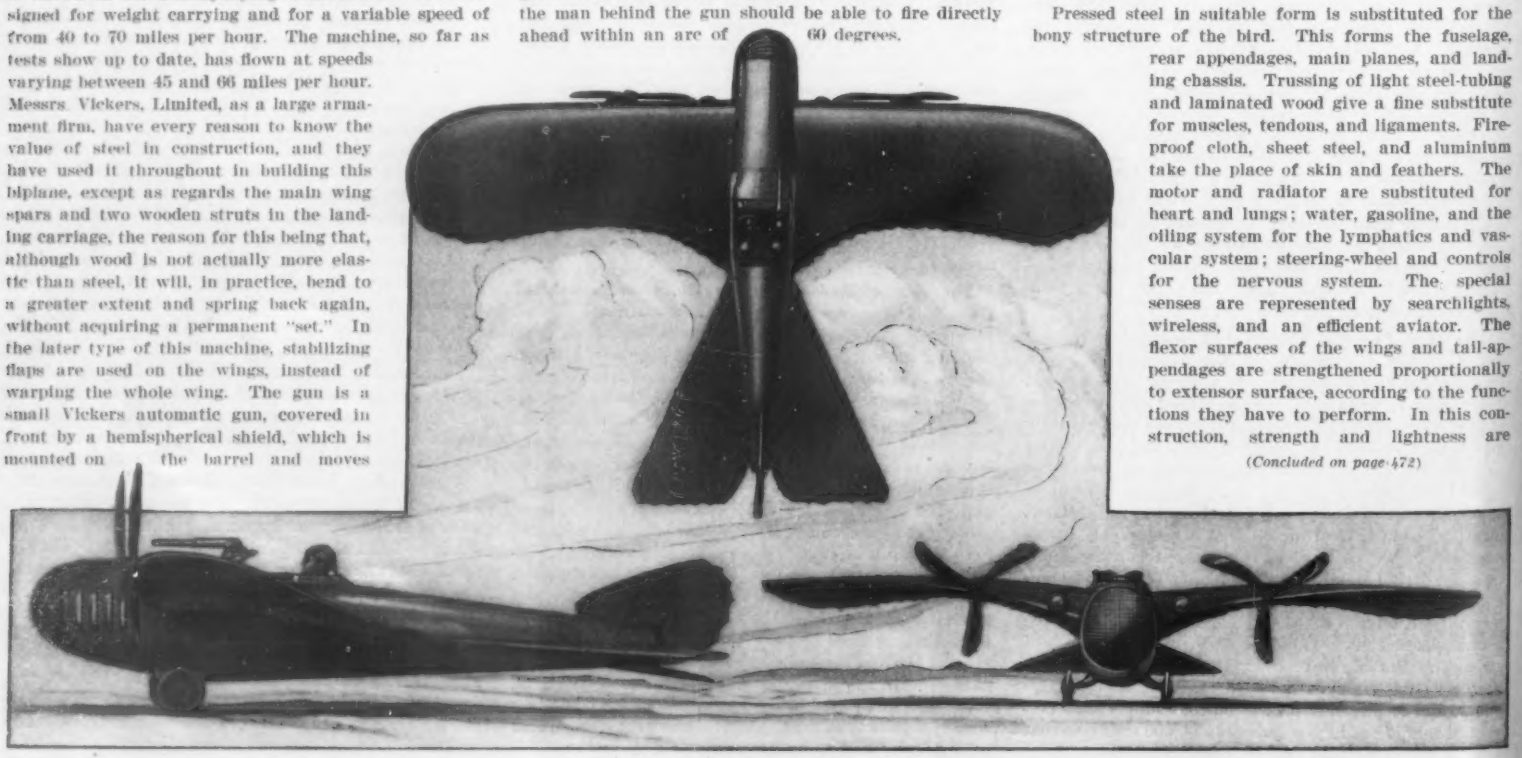
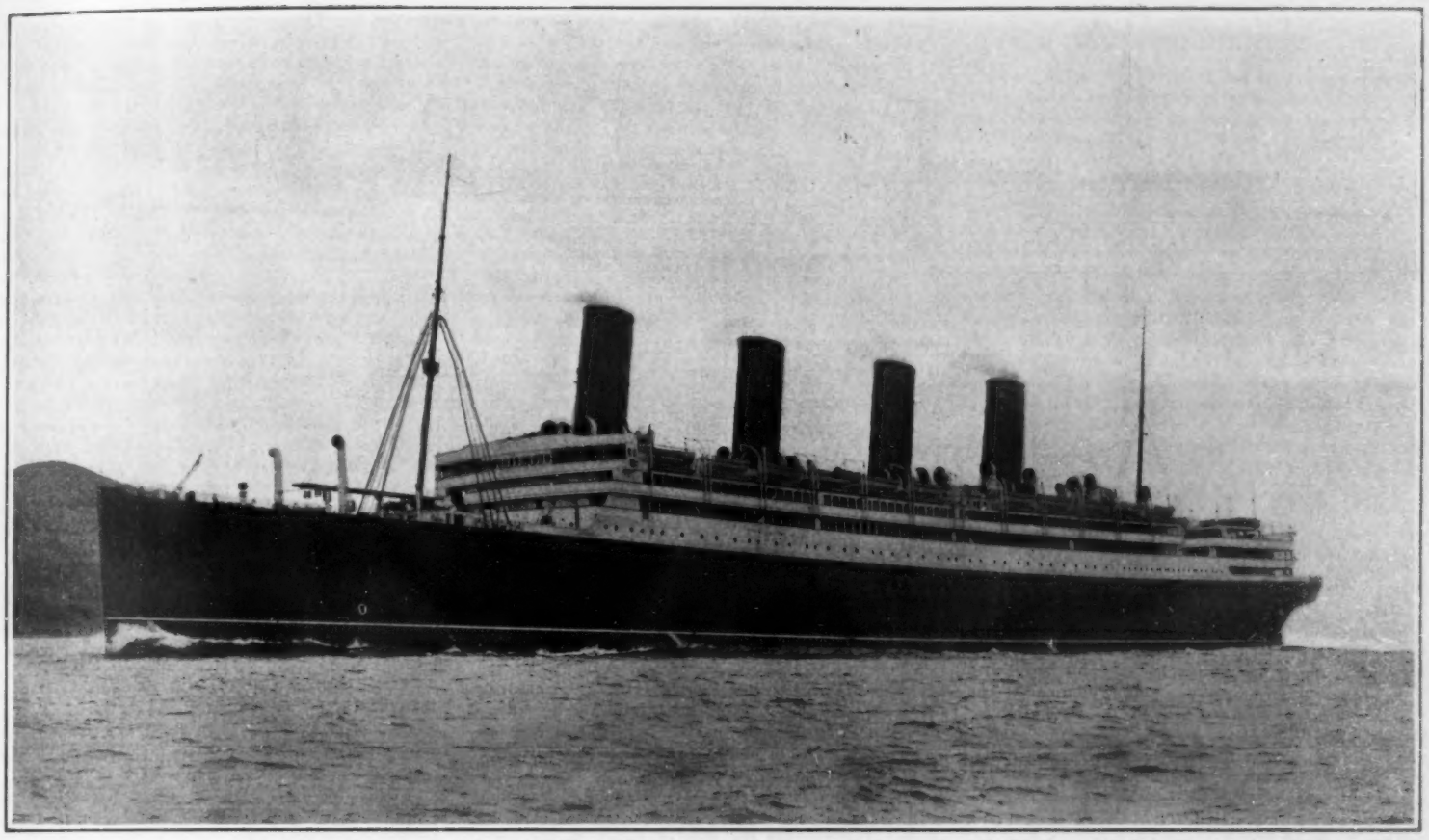


A monoplane built to imitate a bird.



Length, 901 feet; beam, 97 feet; depth, 92 feet. Gross tonnage, 47,000 tons. Displacement, at 36 feet draft, 53,000 tons.

The new Cunarder "Aquitania."

The New Cunarder "Aquitania"

Another Ocean Liner Over 900 Feet Long Reaches the Port of New York

RESIDENTS of the port of New York are receiving dramatic evidence, these days, of the growth of the transatlantic steamship. In our issue of two weeks ago we illustrated the second of the great ocean liners to exceed 900 feet in length, the "Vaterland;" this week we present illustrations of the latest ship of this type, the "Aquitania," whose length of deck is 901 feet. As one contemplates the truly enormous dimensions of these vessels, reads the statistics of their cost of construction and operation, and takes a stroll through the vast halls, lounging rooms, and promenade spaces, the question inevitably arises: how can such costly ventures be made to return any dividend on the investment? The answer is to be found partly in the economic fact that the larger the ship, the less the cost of carrying a ton of freight or a given number of passengers, and partly in the fact that the possession of these wonderful ships enhances the reputation of the steamship company and so, indirectly, brings revenue into the treasury.

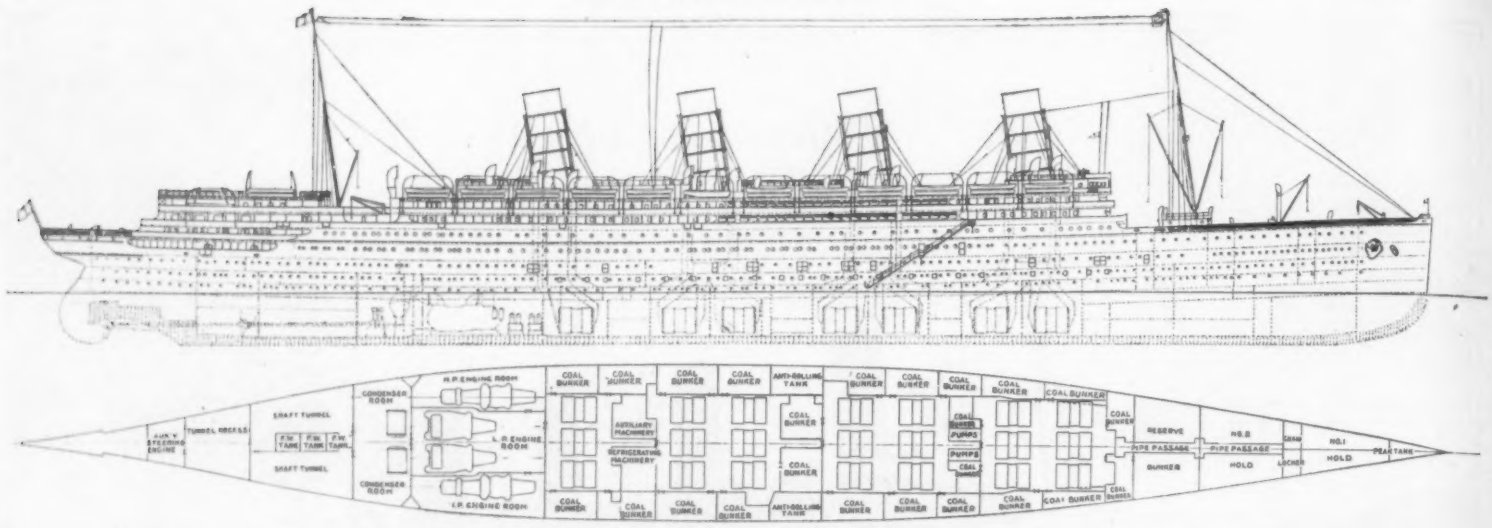
The "Aquitania," which was built at Clydebank, is exactly 901 feet long on deck, 97 feet broad, 92 feet deep to the boat deck, and has a gross tonnage of 47,000 tons and accommodations for between four and five thousand persons. It is an interesting historical fact that, a little more than a century ago, the same waters into which the "Aquitania" was launched witnessed the launch of the pioneer steamship in European waters—Bell's "Comet," which was launched in 1812. This tiny vessel was 42 feet long, 11 feet broad, and 5½ feet deep. It was a few years earlier that Fulton sent the "Clermont" on her maiden trip from New York to Albany and back on the Hudson River.

The "Aquitania," which is considerably the largest ship of the Cunard Line, naturally invites comparison with those two famous boats, the "Lusitania" and "Mauretania." Comparing her with the "Mauretania," we find that she is considerably larger, having a displacement of 53,000 tons on a draft of 36 feet, as against the "Mauretania's" 41,550 tons on a draft of 36 feet 2½ inches. Her horse-power and speed, however, are considerably less, the "Mauretania" having maintained an average speed of 26.06 knots across the Atlantic, with a shaft horse-power of about 74,000, whereas the "Aquitania" was designed to make 23 knots with 56,000 horse-power. However, it should be stated that, during her trial trip, previous to leaving for New York, she made considerably over 24 knots, with a proportionate increase in horse-power, without having her boiler plant pushed to the full limit. The "Mauretania" is 790 feet long on deck, 87 feet 6 inches in beam, and she has a molded depth of 60 feet 6 inches, as against a molded depth of 64 feet 6 inches in the "Aquitania." The gross tonnage of the "Aquitania" is 47,000 and of the "Mauretania" 30,704 tons. The hull of the "Aquitania" weighs 29,150 tons, and the machinery 9,000 tons, as against 19,758 tons' weight of hull in the "Mauretania" and a weight of machinery of 9,402 tons. The "Aquitania" carries 6,000 tons of coal in her bunkers, and the "Mauretania" 6,354 tons. The "Aquitania" has provisions and accommodations for 618 first-class, 614 second-class, 1,998 third-class passengers, and a crew of 972, making a total of 4,202 persons, as against the total number of persons carried on the "Mauretania" of 3,000. It may be mentioned that these figures were given by the designer of the ship, Mr. L. Peskett, in a paper read recently before the Institution of Naval Architects. They are of great interest, as showing that to secure the additional three knots of speed the smaller "Mauretania" requires a greater weight of machinery than the "Aquitania."

Before passing on to further description of the technical features of the ship, mention should be made of those decorative features which form such an impor-

The first-class smoking room.

The restaurant.



Outboard profile and hold plan of the "Aquitania."

taut element of attractiveness in these great ocean liners. The scheme of internal decoration of the "Aquitania" tells the traveler the history of the nation from the far-off days when that "goodlie ship The Great Harry" was one of the world's wonders down to the end of Europe's struggles for supremacy with Napoleon, the period in which Fulton in America and Bell in Great Britain introduced the steamship to their respective countries. The sculptor, the painter, and the engraver have been requisitioned for this work, and the ship is full of rich samples of their work. Among the features provided for the recreation of the passengers may be mentioned the long gallery, which reaches for about 150 feet, and the garden lounge, extending for an equal distance. In the latter, sheltered from wind and weather, with an outlook toward the sea, the treatment is suggestive of an old English garden, the walls of the deck house on one side of the lounge having been treated to represent stone covered with trellis in natural teak. The ship has a large gymnasium and a swimming tank with a depth of 7½ feet.

Construction of the Hull.—There is a double bottom, extending entirely from stem to stern, generally 5 feet 4 inches deep, but increased to 6 feet 3 inches at the turbine room. In this double bottom are forty-one watertight compartments. The central longitudinal girder is built of plates over one inch thick, and this, with two other fore-and-aft girders on each side of it, are solid and watertight. The side framing is of steel channels, with webbed frames 36 inches deep introduced at every third frame throughout the greater part of the length of the ship. All of these extend to a deck 10 feet above the load water-line, and some to decks above this level. The shell plating is 23/20 of an inch thick amidships, the four sheer-strakes being doubled.

Subdivision.—The hull is divided into eighty-four compartments in addition to the forty-one compartments in the double bottom. There are sixteen transverse bulkheads, most of which extend to 19 feet above the load water-line. The turbine room is divided into three compartments by two longitudinal bulkheads, and there is a centerline bulkhead running through the room containing the condensing plant. Eighteen feet in from the outer skin of the ship, on each side, are longitudinal bulkheads forming the inner walls of the bunkers. These extend throughout the machinery and boiler spaces and afford an inner skin to prevent the inrush of water, in case of accident, into the boiler spaces. The hatches to the cargo hold are trunked and made watertight to the weather deck. In her construction the ship may be considered as a box girder formed by the double bottom and the side framing and shell plating, the top of the girder being what is known as B deck, 73 feet from the keel-plate. The shell plating is doubled for a height of 12 feet at the gunwale. For the remaining part of the girder this deck is single-plated. Fore and aft of the machinery spaces is a partial deck, making six within the molded structure of the ship, and there are three superstructure decks above this, making nine in all.

The "Aquitania" carriers 80 large lifeboats, including two motorboats, which are described elsewhere in this issue. For clearing the ship of water, in the event of flooding consequent on collision, pumping arrangements have been provided for dealing with about 16,000 tons of water per hour.

The boiler plant consists of twenty-one, large, double-ended boilers, capable of converting 9,600 tons of water into steam per day. They are operated under a pressure of 195 pounds to the square inch. The ship has four elliptical funnels measuring 24 feet by 17 feet in diameter, and the distance from the top of the funnel to the level of the fire grate in the boiler room is 160 feet.

The turbines are directly coupled to the propellers, and there are four in all, placed in separate watertight compartments. They are operated on the triple-compound system, which gives a great range of expansion to the steam, with consequent high economy. The condensers are filled with 18,700 tubes, which, if placed end to end, would extend for 50 miles; and through the condensers 12,500 tons of water pass per hour for the condensation of the steam. There are over 1,000,000 blades in the turbines, which vary in height from 1½ to 20 inches.

The "Aquitania" has the same beautiful contour and well-balanced position of masts, funnels, deck-houses, etc., which characterizes the "Lusitania" and "Mauretania."

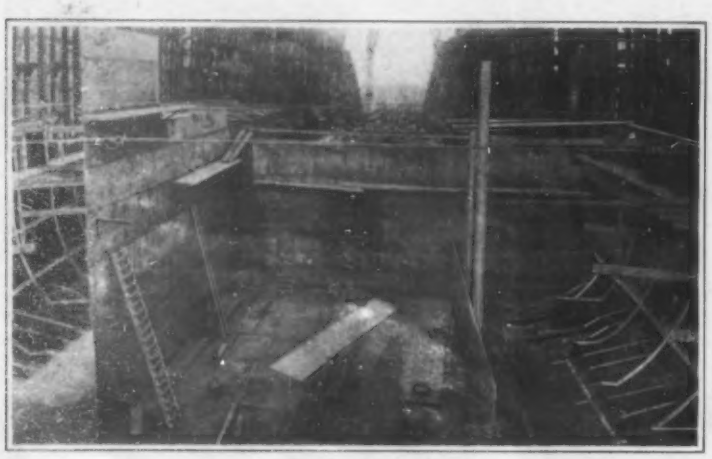
Testing the Langley Aerodrome at the Curtiss Aerodrome

By Our Staff Correspondent at Hammondsport

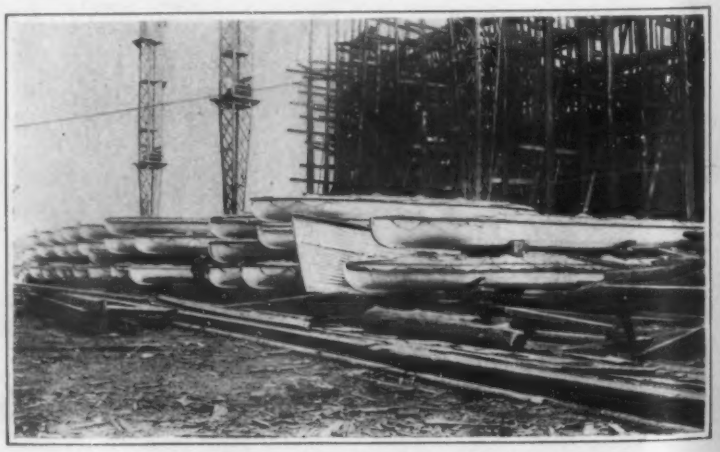
As this goes to press, Mr. Glenn H. Curtiss is on the point of launching the large Langley aeroplane at his aerodrome on the shore of Lake Keuka. The machine and its engine had been shipped from the Smithsonian Institution to the Curtiss factory early in April, and was reclothed without change of size or shape. The framing, the engine, propellers, wings, rudders, and controls are, therefore, just as Langley left them. A modern radiator and carbureter are used, and the whole aeroplane is mounted on three floats, so as to rise from the water. In this way over 200 pounds' extra weight and considerable air resistance have been added to the original machine. With the lowered mass center and lowered line of resistance, the craft is really less steady than the original; yet it is expected to navigate without presenting aerodynamic difficulties. The practical aviators expect it to succeed on the first launching.

For some weeks past the aeroplane has been in the process of re-covering, assembling, taking on floats, and the framework that joins them to the original frame. The whole was suspended by four parallel ropes, as in Langley's day, from the ceiling of the workshop, and moored to the wall by a spring balance attached to its tail. The engine, of some 50 horse-power, set the twin propellers, of 8 feet diameter and 8 feet pitch, whirling at over 600 revolutions per minute, and registered a thrust of 300 to 400 pounds. In the open air, it is expected, the thrust will exceed 400 pounds. This thrust should easily sustain the 830 pounds original weight of the machine, plus the 200, or a little more, due to the hydroaeroplane floats and the trussing above them. As the total wing area equals 1,024 square feet, the whole should lift at a speed neighboring 25 miles an hour.

On the evening of May 26th, the aeroplane, minus wings and tail, was transported to the Curtiss aerodrome, placed on the beach, and adjusted for a preliminary skim on the surface of the lake. A thunderstorm blew up and raged till midnight. Next forenoon the wingless craft was carried from the hangar, set on the water, and started, with Mr. Curtiss as pilot in the little canoe-shaped seat where Manly sat in 1903, when he was shot so heroically into space from the top of the house-boat, then headlong beneath the Potomac waters. Langley's successor and friend, Secretary Walcott of the Smithsonian Institution, now stood near, a complacent and smiling spectator. About him was a little army of aviators and assistants; at his elbow stood his daughter, the keenest spectator of all. The cameras began to click, the craft shot over the water at a 40-mile pace, skimming like a stone, and almost leaping into the air. The small vertical air rudder under the rear center of the frame had not purchase enough to enable Curtiss to turn promptly on the water; so he stopped his engine nearly a quarter of a mile from shore, and allowed a motor-boat to tow him home without delay.



A transverse bulkhead and longitudinal bulkheads in the engine room.



Some of the eighty-two lifeboats of the "Aquitania."

This picturesque and successful run inspired everyone with the belief that, with the wings added, the craft would take to the air well enough to satisfy a moving-picture artist. Some final adjustment was now made in the bevel-gears connecting the engine and propeller shafts, and announcement was made that the real launching would follow presently, if the weather permitted; for heavy clouds were gathering, and it was very moist and hot. An hour later a furious thunder-squall broke over the aerodrome, and the men laughingly remarked that the demons of the air still rage at Langley's invention, and want to destroy his machine.

As the sky threatened during the rest of the day, Mr. Curtiss postponed the launching till the next morning. At sunrise on May 28th, the workmen began fixing the wings on the frame beside the lake, and at six o'clock all was ready. Though the clear sky and mildly moving air seemed most inviting, Mr. Curtiss hesitated to launch, owing to the streaked condition of the water, which indicated a puffy and treacherous air. At seven he took the pilot's wheel, headed in the direction from which the wind appeared to come, and skimmed over the water under full power. The motion was most stately and dignified, but the craft stubbornly veered to port, while Curtiss tried to steer straight ahead with the little vertical rudder. The great tail automatically headed her into the wind from the port side. Presently she rose on even keel, without pitching or rocking, and sailed toward the beach. Mr. Curtiss, erroneously thinking the left side had too much resistance, shut off the power, and was towed back to the hangar. Unfortunately, neither the photographer nor the moving camera man caught the craft in the air. A second launching, after breakfast, terminated prematurely by the giving way of one bearing of the port propeller shaft near the bevel gear, entailing some hours delay for repairs.

Langley's creation is the favorite machine in the factory, even when compared with the transatlantic flier which is building in the neighboring room. The mechanics express astonishment at the perfection of design and workmanship displayed in every part of the old Langley structure. They have been working long hours overtime, for many days, yet each mechanician is as keenly interested and enthusiastic as if the machine were his own. The propulsion plant they regard as a marvel for that early day, 1903—five years before the beginning of public flights in this country and Europe. The brief successful flight of May 28th proved Langley's invention to have been the first machine in history capable of prolonged free flight with a passenger. A great scientist and inventor, misunderstood and persecuted in his lifetime, is vindicated.

The Bachelet Railway

THE Bachelet Railway, with which readers of the SCIENTIFIC AMERICAN are doubtless familiar, since the invention was described in these columns many months ago, has caused some stir in England. Bachelet recently exhibited there the miniature prototype of a 300-mile an hour train. Yet Englishmen, while astonished at the performances of the model, were not blinded, as the following excerpt from the *Manchester Guardian* shows:

"First," remarks our contemporary, " it is an electric railway; but instead of rotary electric motors in the coaches, there are large electromagnets encircling the track at regular intervals, whose function it is to pull the train or coach along, automatic switch-gear cutting in and out each solenoid at the right moment. That this is easily workable for a small model and quite practicable for a full-sized railway is obvious enough; but on the face of it it should be far from economical, even if each solenoid is energized only while a coach is actually within its tunnel, and the air-gap reduced to a minimum. Taking this economical precaution would mean that the coach has to carry in one form or another an armature sufficiently heavy to give the required average pull, though attracted only for a comparatively short proportion of the time occupied by the whole run. As against this—or, at least, one may so consider, though the published accounts do not say so—is the second great feature of supporting the train magnetically in the air. This gets rid entirely of the ordinary rail and journal friction, and so the train might be made as heavy as its peculiar method of propulsion called for without any increased frictional loss, so long as the size or shape was not altered to increase the wind resistance. This alone, under the best conditions, would be enormous at 300 miles an hour; but that is not a greater argument against the Bachelet railway than against any other kind of locomotion at that speed.

"As to the exact method of supporting the coaches we have not much information; but we surmise that the physics of it are nothing more novel than electromagnetic repulsion. When a coil of wire having no self-inductance is placed in an alternating magnetic field, so that the lines of force pass through its turns, an alternating E. M. F. is set up in it at 90 degrees in phase behind the magnetic flux, and, the resultant current in the coil being in quadrature with the flux, the forces between magnet and coil cancel out to zero. The coil, therefore, would make no effort to move. But the ideal of no self-inductance is unattainable in a coil or even in a flat disk (such as M. Bachelet appears to have used to impress his methods on the minds of journalists and others), and, as a result, the current lags by more than 90 degrees behind the magnetism, and the repulsion force predominates to that extent. All this, so far from being new, was stated and explained by Prof. Elihu Thompson long ago, and is the basis of the repulsion motor, which is wasteful, heavy, and expensive. By using a powerful alternating current magnet with, preferably, a high frequency, metal rings and disks of considerable weight may be supported and flung up in the air; and the lower the resistance the greater the effect, because the induced current is greater. Hence, presumably, the disk form. There is reference in the newspaper accounts to other auxiliary apparatus, but too vague to disclose whether this apparatus is calculated materially to improve the economic efficiency of this method of supporting a train. Unless it does, the Bachelet railway's chief claim on the future historian may be that Mr. Winston Churchill went to see it."

The Death of Sir Joseph Swan

SIR JOSEPH WILSON SWAN, inventor of the first incandescent electric lamp, died on May 27th at the age of eighty-six.

Although years of patent litigation have upheld Edison's right to be regarded as the inventor of the carbon incandescent lamp, there can be no doubt that Swan was entitled to a place among the first two or three who gave to the world the present incandescent lighting system. He early showed a marked bent for scientific pursuits, and was accordingly apprenticed to a chemist in his native town. Thence he went to Newcastle, where he was employed in a large house of manufacturing chemists, in which he became in time a partner.

As a manufacturer, Swan was engaged in the production, among many other things, of photographic plates. The dry plates of that time were slow, and instantaneous photography was impossible. Swan experimented, with the purpose of increasing the sensitiveness and rapidity of the plates, and eventually produced the first really rapid dry plates. A valuable pendant to this great achievement was his subsequent invention of carbon printing in photography.

As early as 1860 Swan became convinced that for most purposes the incandescence of a filament, probably of carbon, would be the most practicable source of illumination.

His first electric lamp had a carbon filament which he made by packing a strip of thin cardboard with powdered charcoal in a crucible and subjecting it to intense heat. This was placed in a glass bulb from which the air was exhausted, and an electric current was applied. It will be observed that this was practically the same method that Edison employed in his early operations at Menlo Park in the late '70s. Swan secured his current from a battery of Grove cells, which was not sufficiently powerful to cause complete incandescence, though the filament was heated red hot.

In 1879-1880 Edison gave his first exhibition of electric lighting at Menlo Park, with filaments of paper or bamboo carbonized through intense heat. Late in 1880 Swan gave, at Newcastle, his first public exhibition of incandescent electric lighting on a large scale, using in his lamps filaments of cotton thread "parchmentized" by the action of sulphuric acid.

Another successful filament was made by him by squirting a jet of collodion into a coagulating solution, and then carbonizing by means of heat the tough thread thus produced. This process in modified form supplanted the Edison carbonized bamboo filament both in America and Europe.

The Current Supplement

IN this week's issue, No. 2005, of our SUPPLEMENT, H. Onslow gives some interesting facts regarding the structure and composition of hairs and hair pigments. —The second Wright Memorial Lecture was delivered this year before the Royal United Service Institution by Dr. R. T. Glazebrook, the director of the National Physical Laboratory, London, England. It deals with the services rendered to aeronautics by experimental research, and is reproduced in full in our current issue. —Prof. H. Payne writes on insulation for cold storage.—Dr. M. Philippot contributes an article on legal time in various countries.—J. A. Seager describes one of the most important iron works in Austria.—M. Longridge analyzes the various causes of breakdowns in stationary engines.—Dr. Eccles' review of recent patents in radio-telegraphy is continued, and will be concluded in our next issue.

Washington stands first in lumber production, with Louisiana second.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Misinterpreted Wireless Signals

To the Editor of the SCIENTIFIC AMERICAN:

In the correspondence column of the SCIENTIFIC AMERICAN dated May 16th, 1914, under "Wireless Distress Signals," the writer states that the signal S O S is quite dissimilar to M B S, but, to my way of thinking, the combination of M B S could more easily be mistaken for S O S than any other combination of letters.

If the operator at the receiving station puts the receivers on his head in the middle of the call M B S and the call is not properly spaced, as most calling is not, due to the loss of time, etc., it is a very easy matter to mistake the call and read it S O S, which it would make if the operator at the receiving station took the S to be the first character of the call.

This undoubtedly was the cause of the false S O S on the part of the receiving operator, and the reason the false reports were not stopped by the operator on the "Siberia" was due to the fact that he was out of receiving range of the shore station.

I believe it would be impossible to have any definite tone for distress calls, due to the fact that there are all the tones possible to produce by the different spark gaps and systems now in use. To have a definite tone and keep it uniform on all sets would be an endless undertaking, due to voltage fluctuation, damp condensers, and numerous causes. R. W. WILEY.

San Francisco, Cal.

Nomenclature of Food Values

To the Editor of the SCIENTIFIC AMERICAN:

Food values seem now, according to the current literature, to be classed as "energizers," "calories," "units of energy," "heat-giving qualities," etc., etc., little being said about the upbuilders.

The human body is an engine of flesh and blood and, of course, food keeps the engine going, and it is frequently popularly regarded as of steam-propelling force value only. We put coal in the furnace and about one seventh of its energy is passed on to the engine; the balance goes up the chimney. This steam keeps the engine going, but the moment wear and tear, erosion, friction, etc., impairing the brasses, causing the cylinder to wear or the crank-shaft to need repairing, etc., the steam having no upkeeping, building, repairing influence whatever, trouble results. If the mechanic be not called in, no matter how much steam the gauge on the boiler shows, the engine rocks, pounds, runs down, and the steam becomes of no value. The engine stops, because it is out of repair, and demands that new parts either be supplied or other worn deficiencies be made whole.

And this is where the mechanical properties of the two bodies, the steam engine and the human engine, differ, as to energy influences.

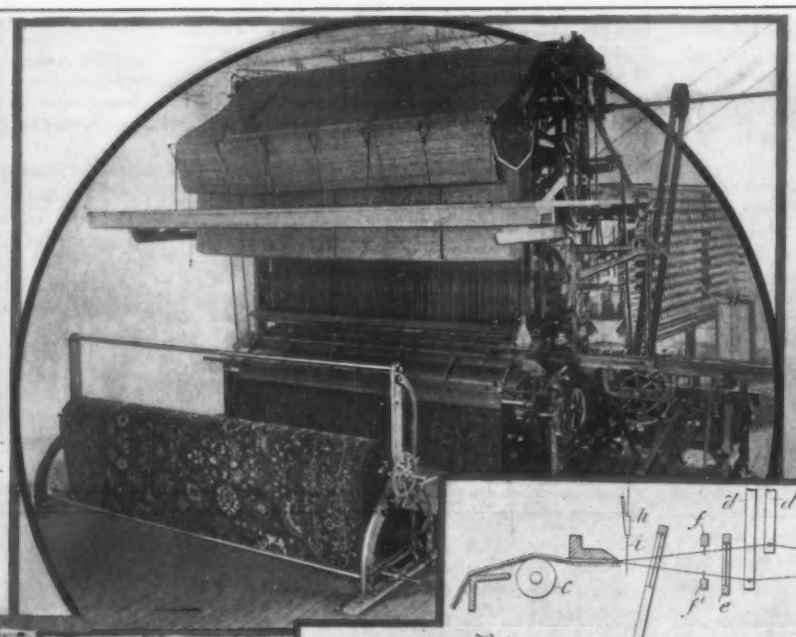
Butter has two and a half times the energizing power of, say, lean meat or the casein of milk, the moisture being equal. Theoretically, on a full meal of butter or olive oil, we should be able to do two and a half times the work that a full meal of meat, or beans, or bread would produce. Butter would be a highly energizing food for the body, but prove worthless as an upbuilder, a repairer of the waste constantly going on with every breath inhaled—exhaled because of its lack of protein content. The same rule holds good with starch and sugar, carbohydrates, heat-givers or producers. But in valuing up foods, whether all protein (building) or partly protein and partly fat and carbohydrates, the *energizing* value of the food only seems to be the index. The protein is also an energizer, lean steak having, presumably, on an average, 950 units of energy to the pound. Macaroni, the genuine American-made article from our northwestern-grown Autumn wheat, so rich in gluten and natural sugar, "macaroni wheat," is credited with 1,650 calories of energy.

But lean meat is, ex the moisture, almost wholly protein, while in macaroni, containing from 12 to 14 per cent of protein, the balance is made up of carbohydrates, starch and sugar, and for that reason one could keep in better health on a protracted diet of macaroni than on lean meat. There is an approximate food balance in macaroni, but no balance in the lean of meat. Potatoes, with a credit of 295 calories energy, contain but 1 8/10 per cent protein, while lettuce, with but 65 calories, has but 1 per cent protein.

So it would seem that when food values are expressed in energies, reference should invariably be made to the upbuilding as well as the heat-giving values. There is more, therefore, than the energy values in food, and whether the proteins are properly balanced with the carbohydrates and fats is of grave moment, indeed.

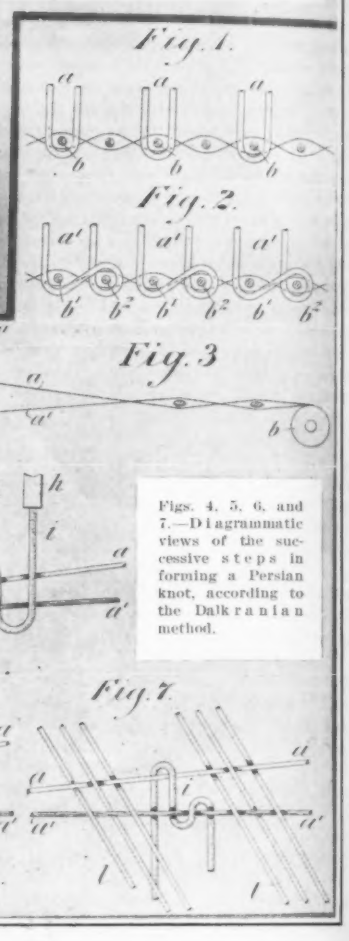
Point Loma, Cal. CHARLES CRISTADORO.

Weavers on the loom of His Imperial Majesty, the Sultan of Turkey, at Herekê, Turkey.



The Talim sheet, which indicates the pattern to the hand weaver.

Fig. 1.—Enlarged longitudinal section of ordinary pile fabric. Fig. 2.—Enlarged longitudinal section of Persian pile rug. Fig. 3.—Diagrammatic view of Dalkranian loom.



Figs. 4, 5, 6, and 7.—Diagrammatic views of the successive steps in forming a Persian knot, according to the Dalkranian method.

A loom that weaves Persian rugs with the characteristic Persian knot.

Weaving Real Persian Rugs on a Power Loom

An Interesting Solution of a Difficult Mechanical Problem

By Theodore G. Hoster

FOR centuries the hand-woven Oriental rugs, and notably the Persian pile rugs, that is, rugs having a pile formed by Persian or Sehna knots, have been admired the world over for their beauty in design and color blending, and prized for their durability. Many attempts have been made by inventors to weave a Persian rug on a power loom to supersede the tedious process of hand-knotting, as practised by the Oriental weavers. The attempts have failed, because the ordinary power loom for weaving carpets and rugs can weave only in a forward direction, while for making a Persian or Sehna knot, a partial return weaving motion is apparently required.

This can best be explained by references to Figs. 1 and 2, of which Fig. 1 illustrates an ordinary pile fabric having each pile *a* looped around a single warp or a weft *b*, and Fig. 2 shows a Persian rug having the pile thread a^1 passing under one warp b^1, then up between the warps b^1 and b^2, completely around the warp b^2, and up between the two warps, b^1, b^2. It will be noticed that the full loop around the warp b^2 requires a backward movement, and this the ordinary power loom cannot do. As a matter of fact, it has been considered by experienced weavers an impossibility to make the Persian or Sehna knot, shown in Fig. 2, successfully on a power loom. The durability of the weave of the Oriental pile rug over the ordinary pile carpet or rug, considering the pile material to be alike, can be readily demonstrated by reference to Figs. 1 and 2. A pull exerted on either pile end of the knot shown in Fig. 1 draws the pile out of the body of the fabric, while a pull exerted on either pile end of the Persian knot, shown in Fig. 2, draws the knot tighter. For this reason it is not necessary to use extra binding threads to hold the Persian knots in place in the weave, as is required in pile fabrics having the pile threads shown in Fig. 1.

Let us now briefly describe the weaving of an Oriental rug by hand. In weaving, or, rather, knotting a Persian rug, the Oriental weavers are squatted in front of a vertically disposed warp depending from an overhead warp beam, as depicted in one of our illustrations. Each weaver, with his or her fingers, deftly ties a knot on a pair of warps (as shown in Fig. 2), the yarn used corresponding in color with this particular part of the design. Next the weaver ties another knot alongside the previous one, on the following two warps. This knotting process is repeated until the weaver reaches the beginning of the row of knots made by his neighbor. Each weaver has a range of about two feet, in a horizontal direction. To tie a single Persian knot requires five distinct finger motions. After a row of knots has been completed a tying weft is threaded on the warp, and the knots and weft are beaten home. The balls of differently colored yarns for the knots are suspended from above, and the weaver cuts off the yarn after each knot is made. In front of each weaver and attached to the warps, a distance above the working row of knots, is a slip of paper (known as the *talim* sheet), which contains the instructions as to the color of the yarns to be used for each knot in each row of knots. These instructions are compiled by special writers from the original design made by a draftsman, but some weavers are skilled enough to evolve a design while weaving a rug, that is, follow their own intuition and produce rugs marvelous in color blending and figuration. The piles are, naturally, of unequal length, and after the rug is woven the pile is sheared to uniform length. That the painstaking Oriental weavers, with the crude means at their command, have been able to produce the wonderful rugs so well known to us all, is truly marvelous.

Although the weave of Oriental rugs has been well known in Europe and America for centuries, although the power loom of Cartwright has been in use since 1784, and although the Jacquard machine for mechanically reproducing the most intricate patterns has been in action since 1801, it remained for an Armenian inventor, James Karmi Dalkranian, of New York, to devise a loom for weaving an Oriental pile fabric having true Persian knots.

In order to accomplish this result, Mr. Dalkranian had to strike out on entirely new lines, which we will endeavor to make clear to the reader by reference to the diagrammatic Figs. 3, 4, 5, 6, and 7. In the loom the warp threads are stretched in pairs *a*, a^1 from the warp beam *b* to the fell of the fabric at the breast beam *c*, and are controlled up and down by heddles *d*, d^1 for periodically opening the shed for the introduction of the wefts or binding threads. Next to the heddles *d*, d^1 is a fixed reed *e* through which pass the warp threads, which receive a sidewise motion by shogging combs *f*, f^1 to permit of alternately crossing the normally parallel warp threads *a*, a^1 and returning them to parallel position between the reed *e* and the fell of the fabric. Next to the shogging combs *f*, f^1 is the intermittently reciprocating lay *g* for beating in the knots and the weft. A tuft yarn tube *h* having an up-and-down and a forward-and-backward movement is used for each pair of warp threads *a*, a^1 to tie a pile thread *i* of a particular color to the pair of warp threads *a*, a^1, and this tuft yarn tube *h* operates closely to the fell of the fabric and in front of the lay *g* whenever the latter is in rearmost inactive position. The movements of the several parts is controlled in the proper sequence by suitable mechanism driven from a main power-shaft. During the working of the loom the shogging combs *f*, f^1 alternately cross a pair of normally parallel warp threads a^1 and then return them to parallel position, and during this time the tuft yarn tube *h* passes twice between the warp threads *a*, a^1, once while the warp threads *a*, a^1 are in the crossed position, and once while they are in the parallel position.

Fig. 4 shows the warp threads *a*, a^1 crossed and the tuft yarn tube *h* returned to uppermost position after its first descent between the warp threads *a*, a^1, so that

(Concluded on page 472.)

A "Varsity" Electrical Show

AN electrical show was recently held at the Ohio State University which proved an unqualified success. It was given by an enterprising association of one hundred young men, constituting the Ohio State University Branch of the American Institute of Mechanical Engineers. A string of lights from the University entrance to the Electrical Building, an immense "Electrical Show" sign, an electric waving American flag, a string of arc lights about the eaves of the Electrical Building, and a large searchlight mounted upon the building, made known to passers-by that the Electrical Show was on. The show was divided into two parts, one devoted to the exposition of commercial appliances, while the other related more particularly to demonstrations of curious and novel electrical effects, such as experiments with high-tension high-frequency currents, frying eggs on ice with the aid of eddy current, demonstrations of wireless telegraph apparatus, the singing arc, the loud-speaking telephone, and the like. Local electrical manufacturers supported the show with exhibitions of apparatus. Altogether there were about forty exhibitors in that section. The fact that the receipts were three times as much as the expenses may be taken as a measure of the success of the show. All the standard features of an electrical show, such as given in New York or Chicago, were to be found on a smaller scale at this exposition.

A Gasoline Switching Engine

By Our Berlin Correspondent

THE odd little piece of mechanism tucked under the end of a freight car in the accompanying photograph is a 20 horse-power switching engine, designed by a German firm. To insure the necessary traction the "locomotor," as the little switching engine is called, is furnished with a jack which is operated to lift the platform of the freight car, thus increasing the weight on the tractor wheels, and hence their adhesion to the rails. The jack is also fitted with means for coupling the locomotor to the car.

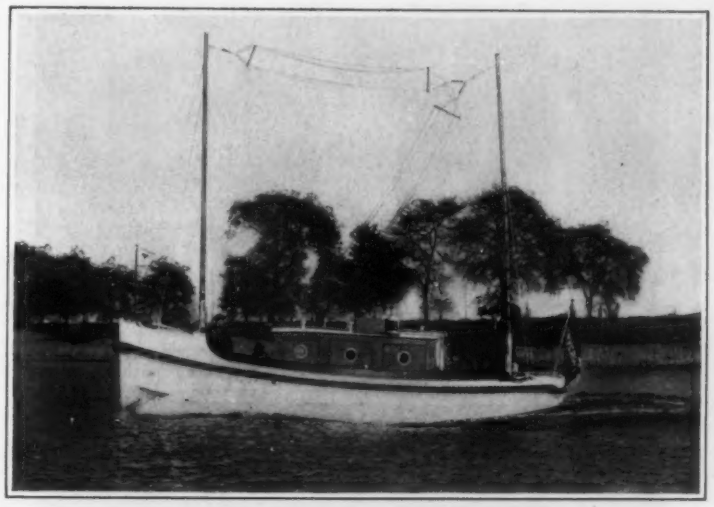
The chassis is made up of substantial angle and channel irons and rests on two sets of steel wheels running in roller bearings. It is so designed as to insure perfect protection as well as an easy access to all the main interior parts—motor, carbureter, radiator, fuel tank, gearing, bearings, control gears, etc. The motor is a vertical four-cylinder 20-25 horse-power combustion engine of the constructor's own design. The running wheels are driven through the gearing, chain-wheel and chains, levers serving to actuate the forward and backward steering, and to regulate the carbureter and speed gear, while pedals are used to throw the motor out of gear. All levers and pedals are operated by the driver, from his stand on the locomotor platform, or from the ground beside the vehicle. The locomotor is fitted with a capstan, driven direct from the gearing, and which serves mainly for the actuating of turntables.

The uses of the locomotor are many. Being always ready to work at a moment's notice, and able, without any special manipulation, to travel in a forward or backward direction, it will convert any railway car into a motor coach, traveling along with it over turntables, operating these by the aid of its own capstan, hauling or pushing several cars at a time, loaded or empty, over any normal curves or gradients, and braking on a downhill course.

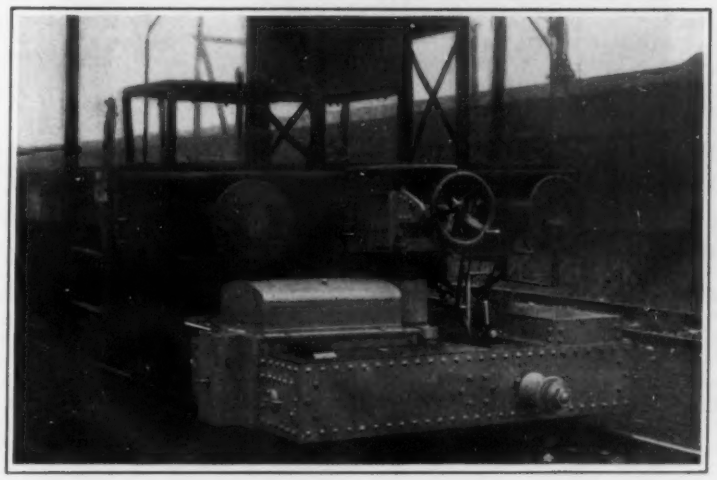
The locomotor is readily operated by one man and does not depend for the consumption of materials on the skill of the driver. There is no increase in consumption due to the weight of the engine itself, or the coal, water, steam, or accumulators carried. During intervals in operation there is no consumption of materials.

It is intended to fit the locomotor with transversal wheels, allowing of its leaving the track wherever desired, and travel from one track to another, thus avoiding any dead-end sidings or empty tracks, and insuring a considerable saving of time.

Electrical show at the Ohio State University.



Radio-equipped motor lifeboat for the "Aquitania."



Motor switching engine, utilizing the weight of a freight car for traction purposes.

Machine for making artificial surf.

Protection from Trichinosis has recently been investigated by the Bureau of Chemistry, with a view to establishing a basis for meat inspection requirements in regard to cooking pork products. Experiments show that the trichinæ larvæ die after a brief exposure to a temperature between 53 deg. and 55 deg. Cent. (127.40 to 131 deg. Fahr.). These temperatures are so low that one might expect very imperfect cooking to secure the desired result; it has been found, however, that the temperature in the interior of meat rises very slowly during the cooking process, and it is of course essential that the whole of the meat should be heated to a temperature high enough to destroy the parasites. Tests for insuring a proper temperature have been devised, and will soon be put in operation in meat-packing establishments.

Motor Lifeboats of the "Aquitania"

WHEN the passengers and crew of a vessel are forced to take to the lifeboats, if help does not arrive soon, the boats are apt to be so widely scattered that it is difficult for rescue ships to locate them. A frightful illustration has only just been furnished us by a lifeboat that was picked up the other day with a few survivors two weeks after the other boats from the same wreck had been rescued. No matter how good the lifeboat, it may fail in an emergency, because it possesses no means of propelling itself to safety and no means of communication with rescuers out of sight and hearing. With this in mind, the owners of the "Aquitania" are furnishing that vessel with two large motor lifeboats fitted with wireless telegraph apparatus, these, of course, being additional to the regular lifeboat equipment. The motor boats are 30 feet long by 9 feet 6 inches wide. They will be used to tow the ordinary lifeboats. The wireless apparatus has a range of 100 to 150 miles, which will enable them to keep in constant communication with steamers. The boats are fitted with 4-cylinder, 30 horse-power motors, starting on gasoline and running on kerosene. The motor is well protected from storms by a closed compartment. There is ample space for storage of blankets, medical stores, and other necessaries.

A Memorial to Jack Phillips, the chief wireless telegrapher on the "Titanic," is to be erected at his native town, Godalming, England. It will take the form of a rectangular cloister of some 120 feet square, and will stand on glebe land near the parish church. The cloister style is a new form of memorial architecture in England, where it has been warmly approved by architects and art-lovers generally.

Ocean Waves for Inland Resorts

THE odd-looking piece of machinery shown herewith is a wave-making machine. It will make, to your liking, any one of a half dozen or more different kinds of waves: Ocean waves, long rolling billows, short choppy waves, and, among others, the white-cap variety. It is possible to have a real Atlantic City surf just by switching on an electric motor, which sets the four plungers in motion. These plungers work up and down in the water, and the different ways the plungers are worked make the different kinds of waves. For instance, if long rolling billows are desired, the plungers are worked in unison. If a short choppy sea is wanted, the plungers are worked independently of each other; when white-caps are wanted, two plungers are worked up and two down; this combination causes the waves to break into white-caps. The different combinations of the plungers result in the different kinds of waves. This unique mechanical device will be used at Summer resorts this season, on lakes that never saw a wavelet larger than a ripple.

How the Roots of Seedlings Write

Interesting Experiments for the Summer Season

By S. Leonard Bastin

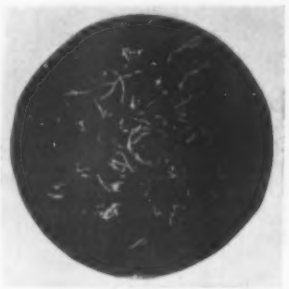
THE mystery of plant movement has always presented a problem of peculiar complexity to the botanist. While the text-books discourse authoritatively upon the response of the protoplasmic matter in vegetable tissue to stimuli, the conscientious student is bound to confess that, after all, we know very little about the matter. The most that can be said is that certain parts of the plant may be expected to do certain things, because they have been endowed with a tendency in that direction. Still, a very interesting line of study may be followed in connection with the movements of plants, and one which cannot fail to lead to instructive conclusions.

It was believed by Darwin that all growing shoots were constantly on the move, to a greater or less degree. This habit is seen to the most pronounced degree in the species with twining stems and in some of the Acacias, where the leaves maintain a continuous rotary movement. The name given by the great scientist to this phenomenon was circumnutation, and it was to this feature that Darwin thought he could trace all kinds of plant movement—a theory which is not however generally accepted at the present time. Perhaps even more interesting was the fact that it was discovered that a very similar movement is to be noticed in the roots of young seedlings. In this direction it is possible to carry out a large number of most fascinating experiments indicating the curious and beautiful courses which the radicles of growing seeds will trace in the early stages of their history.

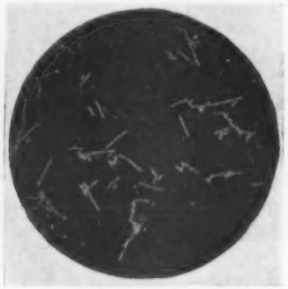
Probably one of the simplest devices by means of which the root movements of seedlings may be closely watched, is an ordinary photo-printing frame. These are, of course, very inexpensive, and answer all the purposes required. Pieces of glass to fit the frames should be obtained, and for this purpose, of course, damaged negatives with the film cleaned away are exactly right. It is also needful to obtain some pieces of very coarse canvas or fine netting, with a mesh through which the rootlets of the seedlings can easily force their way. This material should be cut into pieces of such a size that they cover the frame, at the same time allowing for strips on either side to turn down. A few tacks will complete the necessary things required for making the appliance for testing the root movements of seedlings. The loose backs of the frames are now entirely dispensed with, and, as well, the clasps which hold down the hinged portion should be removed. The next step is to place the frame face downward on a table and stretch the canvas across the back tightly, and holding it thus, fasten it down to the sides of the woodwork, as shown in the illustration. It is important that the material should be pulled across quite tightly, as any sagging of the cloth is very undesirable.

When the frames are completed, it is as well to start smoking the sheets of glass, in order that a suitable surface may be presented on which the seedlings may trace their movements. This may be accomplished in a variety of ways, but the best and simplest method is by using an ordinary candle. First of all make sure that the glass is quite clean and dry, and then taking it between the finger and thumb, hold it over the flame in a slanting fashion. In order to get the greatest amount of smoke, the surface of the glass should just touch the top of the flame. The glass should not be held for more than a second in any one position, as the heat will be likely to crack it, but if the sheet is kept moving about there will be no danger of breakage. Very soon the glass will become well clouded, but the process will not be complete until the surface is thickly coated with the smoke deposit, so that the slightest scratch will leave a sharp, clear mark. As each piece of glass is ready, this should be carefully stored away in a place of safety where there is no fear of damage being done, and also in a position sheltered from dust.

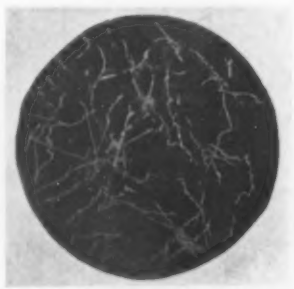
Almost any kinds of moderate-sized seeds are suitable for testing on the frames which have been prepared. Of course, very large kinds develop such big roots that these are unable to pass through the openings in the canvas, but putting these aside, there is an infinite variety in the subjects which may be tried. A peculiarity should here be noted in connection with the seeds of most leguminous species. Some small sorts of beans and peas have been tried, but it has been found quite impossible to induce them to trace their life history on the smoked surface. In most cases, before the tip of the radicle has reached the black surface, it has suddenly ceased growth and absolutely refused to push on downward to the impenetrable glass. This seems to indicate a perception which almost amounts to intelligence on the part of the radicle, giving yet further support to the theory that the tips of growing roots are as sensitive to their surroundings as are many of the organs of the lower animals. In order to make the experiments more interesting, an endeavor should be made to select as wide a variety of seeds as possible, so as to secure the greatest diversity in the records.



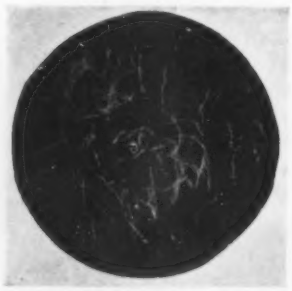
Seedlings of Centaurea cyanus.



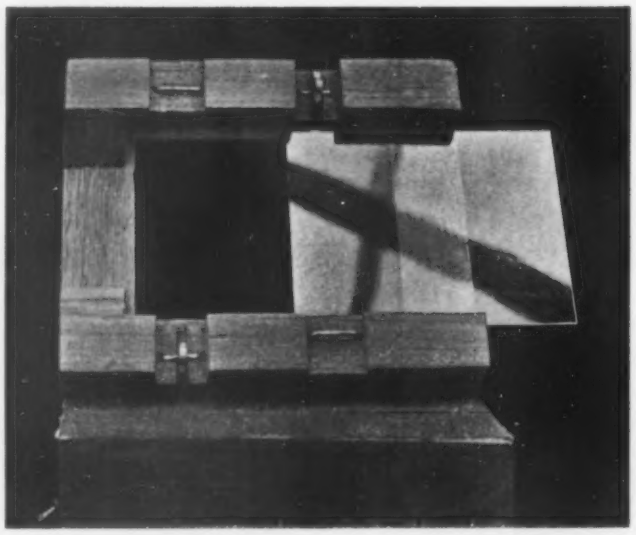
Tracing by mustard roots.



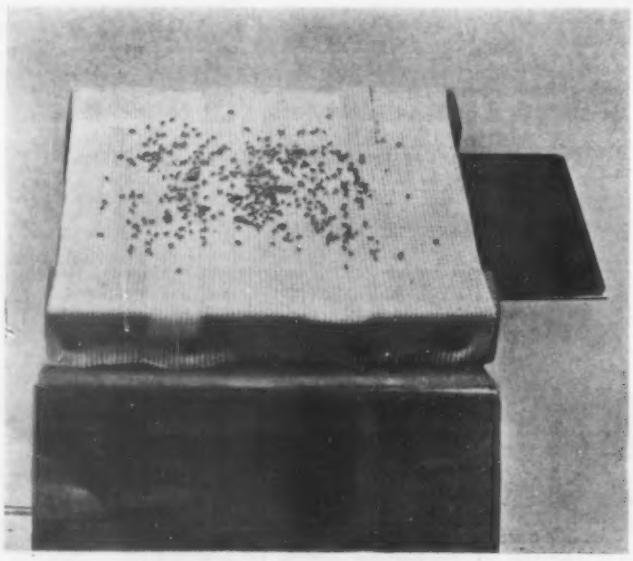
Cress root tracings. These are among the best obtainable.



Produced by seedlings of wallflower (cheiranthus).



The framework is made out of a photograph printing frame.



The seeds are sown on a piece of canvas stretched over the frame.

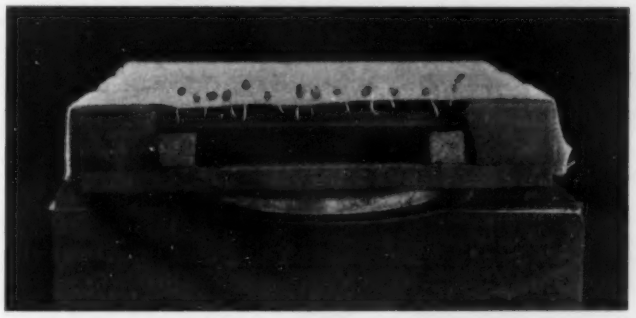
The best method of sowing the seed on the surface of the canvas is to sprinkle it over with a spoon. The thickness or otherwise of the sowing should be arranged according to the nature of the pattern required. If the seeds are sown very thinly, each one being quite isolated from its fellow, we shall obtain a record most interesting from a scientific point of view, in that the actual movements of the individual radicle are placed on record. On the other hand, designs of great complexity are secured by sowing the seeds very thickly on the surface of the canvas. As soon as the sowing is accomplished, a thorough drenching of water should be given to the seeds, and care taken to see that the canvas is quite wet. All seeds, of course, germinate more rapidly in the dark, and in this case it is a wise plan to cover them with a piece of thick cloth or wadding which has been previously saturated with water. This will not only keep away the light, but will also serve the purpose of conserving the moisture. Of course, on no account must the seeds be allowed to become dry, and in order to make this quite impossible, it is well to stand each frame in a dish containing about half an inch of water. By capillary attraction, the fluid is drawn up all over the canvas, and one can well go away and leave the seedlings for a day or so, provided an occasional glance is given to see that the water is maintained at a proper level. There is a wide difference in the time which seeds take to germinate. Some kinds, such as mustard, cress, and nearly all the cruciferous plants, start active growth in a few days, while other sorts will lie dormant for quite a long period. Of course, another feature which goes a long way to control the rate of growth of any seeds, is the temperature. During warm weather, or if the seeds are kept in a heated apartment in Winter, the development will be much more rapid than when the conditions surrounding the seeds are chilly.

As soon as the germination is once started a close watch should be kept on the underside of the canvas for the appearance of the rootlets. At the first sign of the radicles, measures must be taken to place the pieces of smoked glass underneath, as in many cases the movements are most pronounced of all during the first stages of growth. It will probably be desirable to make some arrangements whereby the smoked surface can be brought nearer to the roots, and some means of supporting it underneath with strips of wood is easily adopted. It is necessary to make certain that the smoked glass is quite unscratched, and also in placing it in position that it does not get marked in any way. To insure this, the glass should not be placed nearer than an eighth of an inch to the roots which are growing downward so rapidly. The following day it will be observed that the roots have touched the surface and are already scribbling out a course. If the frame-

work is held over one's head the lines of clear glass stand out prominently against the dead black, and the fascination of watching the roots writing out their life history will amply repay for any trouble which may have been expended on the preparations. Some of the prettiest formations are those in which the radicles are abundantly supplied with roots' hairs, a good example of which is seen in the case of the cress pattern.

Of course the roots may be permitted to write for a longer or shorter period, and it is a matter which varies with each kind as to how long the process should be allowed to proceed. Eventually, if the tracings are permitted to go on indefinitely, the radicles become so elongated that other portions besides the tip commence to touch the smoked surface, and in this way the record is spoiled. In removing the glass great care is required, and at this stage it will be an advantage if the sheet has been supported by strips of wood, as mentioned earlier. If this is the case, by sliding the pieces of wood out, the glass drops away without the least fear of the roots being dragged across the smoky surface. The sheets of smoked glass are so easily damaged that most people will probably be glad to preserve the record of the seedlings' roots in a more permanent form. The illustrations accompanying the present article were prepared in order to give the true effect of their appearance, but a much simpler method is that of printing directly from the glass, which has been used during the experiments. The plates may be used as negatives, the smoked side being turned outward in the frame, and the sensitive printing-out paper being placed next to the plain surface of the glass. Of course the result will be that the tracings of the roots will be in black, but this does not in any way affect the value and interest of the records.

While it is impossible to go very deeply into this interesting behavior on the part of the roots of seedlings within the limits of the present article, there is little doubt that it must play a very useful part in the life of the plant. One of the greatest dangers to the extending root is that of meeting some obstacle in its course which it is unable to penetrate. Now if all radicles were to go downward in a straight line, it is quite clear that the risk of coming to a dead stop would be considerable. On the other hand, the constant moving about from one side to another results in a continual change of position, so that if a stone or some such obstacle should stand in the way of the course, the tip of the root is speedily carried to an altered position. Even after the most careful observation of the root habits of seedlings, it is impossible to say how far these movements are habitual and how far they are controlled by actual environment. Indeed, in many cases it is difficult to avoid the conclusion that the underground organs of plants are gifted with special senses of which we have little or no understanding.



The growing seeds in position, with the root tracing a course on the smoked glass.

Mammellicæ centricirrhha.

New Work in Spectrum Analysis

By John W. N. Sullivan

THE method of spectrum analysis is based upon the well-known discovery of Sir Isaac Newton, that ordinary white light, on being passed through a prism, is split up into light of different colors. If, after the light has passed through the prism, it be projected upon a screen, we find a series of colors ranging from red at one end to violet at the other. Such a series, obtained in this way, is called a spectrum. Instead of a prism, it is more satisfactory, for many reasons, to use what is known as a diffraction grating, which consists of a piece of metal or glass ruled with fine lines very close together, there being usually 10,000 to 20,000 of these lines per inch. A diffraction grating splits up composite light into its constituent colors, and does so in a uniform manner; whereas different prisms decompose light differently, a fact which renders prisms less suitable than diffraction gratings for scientific work.

The spectra produced by different sources of light differ enormously from one another, a fact which renders spectrum analysis possible.

Before considering some of the recent achievements in the domain of spectrum analysis, it will be convenient to adopt a broad classification which will include all spectra.

The spectra of light emitted from various sources and passing direct to the analyzing apparatus are called emission spectra and may be divided into three classes:

Continuous Spectra, where we have merely a sequence of colors ranging from red to violet.

Line Spectra, where colored lines are found in their appropriate portions of the spectrum—for instance, a vivid green in the green region of the spectrum.

Band Spectra, where bands, sometimes of considerable width, take the place of lines in the spectrum.

In many cases bands may be split up into a number of lines packed very closely together by employing higher resolving power, but it is not certain that all bands may be split up in this way. The bands are usually more brilliantly illuminated at the edge nearest the violet end of the spectrum, although this is by no means an invariable rule. If now, instead of allowing the light to pass direct to the analyzing apparatus, we pass it through a gas or vapor at a lower temperature than the source of light, we get a different type of spectra, called absorption spectra. These spectra are characterized by having dark rays or bands on a bright background. The dark lines in the absorption spectrum correspond to bright lines emitted by the absorbing medium when in a state of incandescence.

If the light of the sun be examined by sufficiently high resolving power, it is found that its spectrum contains multitudes of fine dark lines, indicating the presence of absorbing gases in the sun's atmosphere. The exact positions of these lines in the spectrum are very carefully noted, and experiments are made to determine which gases have bright lines in corresponding parts of their emission spectra. In this way it is possible to identify the gases forming the atmosphere of the sun.

Corresponding to each line in the spectrum is a definite wave-length. If now the observer and the source of light are approaching one another, the wave-lengths appear shortened and the spectrum lines are shifted toward the violet end of the spectrum, where the wave-lengths are shortest. If, on the other hand, the observer and the source of light are receding from one another, the wave-lengths appear lengthened, and the spectrum lines shift toward the red end of the spectrum. From measurements of the amount of shift, the relative velocity of light source and observer may be calculated. It is in this way that the radial velocities of many stars have been measured.

It is well known in our day that the visible spectrum is not the entire spectrum. Extending past the limits of visibility at the violet end of the spectrum, we come to the ultra-violet rays, whose presence may be detected by their action on a photographic plate. At the other end of the spectrum, extending below the red rays, we reach the region of the infra-red, which passes gradually into the region of the heat rays. The presence of the infra-red rays may be detected by their heat effects. Taking longer and longer rays, we reach, finally, the long electromagnetic waves, and in the other direction, far beyond the violet, it is now considered very probable that we reach those excessively short rays known as X-rays.

As an indication of the magnitudes involved, we may mention that the solar spectrum has been mapped out from wave-lengths 53,000 Angstrom units in the infra-red to 2,976 Angstrom units in the ultra-violet. An Angstrom unit is one ten-millionth part of a millimeter.

The wave-lengths of visible light lie between 4 by 10^{-5} centimeters and 7 by 10^{-5} centimeters. In the ultra-violet region waves as short as 1 by 10^{-5} centimeters have been discovered by Schumann, but in a paper published in 1912 by Friedrich, Knipping, and Lane phenomena are described which can only be due to waves of a length of about one hundred millionth of a millimeter, a length which is small compared to the radius of an atom!

A remarkable set of phenomena are comprised under the name *fluorescence*. It often happens that when light falls upon a substance, the substance emits light of a different color to the exciting light. This phenomenon is known as fluorescence and has been the subject of much recent work. Fluorescence is most markedly produced by the very refrangible rays, blue, violet, and ultra-violet.

In this connection Stokes enunciated the following law: The radiations emitted by a fluorescent substance possess greater wave-lengths and are less refrangible than those of the exciting light. It was at first believed that this law held good universally, but it was shown by Nichols and Merritt in 1904, in their researches on the spectra of fluorescent light, that in many cases this is not obeyed.

The fluorescence of bodies in the gaseous state was first observed by Lommel in his studies on iodine vapor, and later a whole series of fluorescent vapors have been discovered.

Some very remarkable work on the fluorescent spectra of sodium and iodine has been done by R. W. Wood. The spectra obtained by exciting sodium vapor or iodine vapor by light of a small range of wave-lengths (monochromatic light) he calls resonance spectra. It would appear that light of a certain wave-length falling on the systems of electrons which constitute the atoms of the vapor set up vibrations of the same, or approximately the same frequency, producing corresponding lines in the spectrum; that we have, in fact, a case of resonance. There would appear to be a strong connection between the bright resonance lines of these vapors and the dark lines of their absorption spectra. In all Prof. Wood's earlier work, he was of the opinion that each bright resonance line was in coincidence with some one of the numerous dark absorption lines, but in his last paper (*Phil. Mag.*, November, 1913) he finds that this is not the case. There can be no doubt that further study of these spectra will throw much light upon the intimate structure of the atom.

Spectrum analysis is thus seen to have a wide range. It is our only means of obtaining information as to the physical constitution of the heavenly bodies, and at the other end of the scale, it teaches us a great deal about the constitution of the smallest bodies in the universe.

The Disappearance of Gustav Hamel

EARLY in the morning of Saturday, May 23d, the well-known English aviator, Gustav Hamel, left Villacoublay, France, for Hendon, England. He was last identified at 12:15 P. M., when he left Hardelot, near Boulogne, on his way to Hendon, but a monoplane supposed to have been his was seen high in the air above Boulogne at 12:30 P. M. Wireless messages were sent to all ships in the Channel to watch for the aviator, but none of them has made a report of having seen the machine. Hamel recently announced that he would attempt to fly across the Atlantic for the Harmsworth prize. He was the first to repeat the upside down performances of Pegoud. His fate recalls that of Cecil S. Grace, who crossed the English Channel from England to France in December, 1910, and who disappeared on a return flight on December 22d.

A New Record for Dirigibles

THE new navy Zeppelin "L 3" recently stayed aloft for thirty-four hours, during a voyage from Friedrichshafen to Potsdam. An average speed of nearly 60 miles an hour is said to have been attained. While over Heligoland the "L 3" was in communication by wireless with dirigible "LZ 24," which was over Friedrichshafen.

Powerful Wireless Outfit for the Army.—According to the *Army and Navy Journal*, should an advance be made on Mexico, great reliance will be placed upon a strong force of cavalry assisted by aviators and an unusually powerful wireless outfit. A test was made by the Signal Corps at Washington of a wireless outfit mounted on a heavy automobile truck, which has an estimated range of 200 miles. If this range is realized, the Army will be in touch with the base at Vera Cruz until it reaches the gates of Mexico City.

Ancient Footwear Found in London

THE ancient shoes and sandals, pictured in the accompanying engraving, are not replicas, but the actual footwear of men who once trod the streets of London. They were dug up within the city limits and are on exhibition at the city museum. The two sandals shown date back to the days of the Romans. They were found in the peaty deposit of the Moorgate Street district. They have been set up on plaster feet. On the left are two Saxon shoes. The one at the top resembles the Scottish and Irish brogue used at the present day in the Shetland Isles. It was discovered in London Wall. The shoe directly below it, with the iron stirrup, was found in the Ditch, Newgate. The shoe with long-pointed toe, at the bottom of the engraving, belongs to the early fifteenth century. The iron stirrup was found in Westminster, while the spur was dug up in Thames Street.

It was during the reign of Richard III that this odd shoe, or "poulaine," was in fashion. To keep the long toes of these shoes in shape, they were stuffed with moss.

Courtesy of the *Sphere*.

Curious ancient footwear dug up in London.

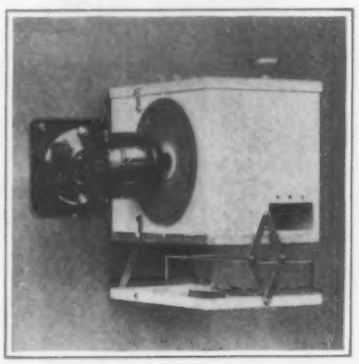
Measuring Moisture at a Distance

IN granaries, breweries, malt houses, spinning mills, gunpowder and explosive factories, grain houses, etc., great importance attaches to the amount of water vapor present in the air, and it is necessary that the amount of moisture present in the air should be capable of determination at any time with the minimum of trouble.

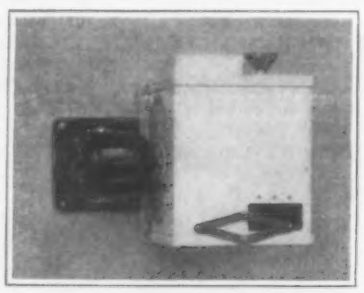
One of the difficulties in this connection is the fact that many of the positions in which the atmospheric conditions have to be determined are not suitable for accurate observation, and hence the Constanz Schmitz system of hygrometers suitable for measurement at a distance. The Schmitz hygrometer is based on the principle of the well-known aspiration hygrometers. Thermometers of a special type are used, consisting of a resistance coil of pure platinum wire, wound in a spiral form, on a central quartz tube, which is then inserted into a closely fitting outer protecting tube of the same material. The whole arrangement is fused together, so that the platinum spiral is hermetically sealed, while any risk of the short-circuiting of adjacent turns is completely eliminated. The resistance of the spiral is accurately adjusted to a definite value. Two of these quartz glass resistance thermometers are mounted in an oblong case which is fixed in the room whose hygrometric condition is to be controlled; the accompanying drawing shows the arrangement. One of the thermometers *A* is covered with a porous tube which is partly immersed in distilled water contained in a tray *C*, which serves to keep the thermometer wet. The second resistance thermometer *B*, separated from the thermometer *A* by a diaphragm *D*, is the so-called dry-bulb thermometer. The air whose hygrometric condition is to be determined, passes through the oblong case and causes evaporation to take place on the surface of the wet-bulb thermometer *A*, with the result that heat is extracted from it in this way. A difference in temperature between the wet-bulb thermometer *A* and the dry-bulb thermometer *B* is set up. If the air were saturated with moisture, no evaporation would occur, and in this case the temperature of the two thermometers would be identical. On the other hand, if the air were very dry, rapid evaporation would take place on the surface of the wet-bulb thermometer *A* and its temperature would be reduced, causing a considerable difference in temperature between the two thermometers. The relation between this difference in temperature and the humidity at various temperatures has been determined scientifically. A ventilator fan provides the proper velocity of air past the thermometers. The fan motor is switched on and off simultaneously with the thermometers. A central temperature indicator is mounted on a switch-board, to the back of which are fixed the necessary resistance coils and connections. Below the indicator are the push-buttons, by means of which any one of the distance hygrometers may be connected to the indicator. There is also a variable resistance to eliminate any error due to slight variations in the voltage of the battery by adjusting the resistance, while a test key is depressed until the indicator pointer shows exactly full-scale deflection. The push-buttons are interlocked, so that it is impossible to connect more than one thermometer with the indicator at the same time. When a button is pressed down, it remains down until a second button is depressed, when it automatically returns to "off" position.

One button is provided as a releasing key, for use when it is desired to disconnect a point without connecting another in its place.

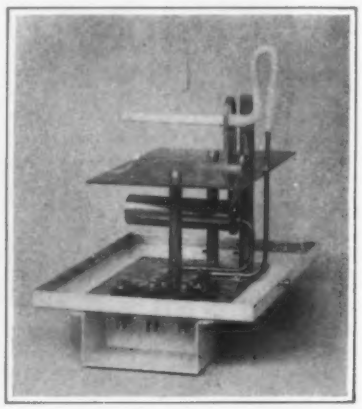
To take a reading, the push-buttons for the wet and dry-bulb thermometers are depressed, one after the other, and the temperatures are read off on the scale. By using a suitable conversion table, the readings can then be translated into measures of relative humidity. The instruments are of the Siemens type and have been produced in England.



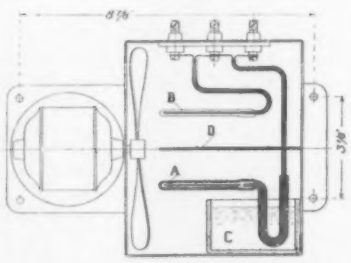
Bottom lowered to provide access to the water tray.



Hygrometer in normal closed position.



Casing removed to show the thermometers.



Sectional view of the hygrometer.

Aeroplanes and Gyrostat Control

A DEMONSTRATION of gyrostatic action was given recently before the Physical Society meeting in the Imperial College of Science, by Dr. G. Gray, of the Department of Natural Philosophy at the University of Glasgow. Dr. Gray showed three distinct methods of producing stability in a gyroscope mounted on such a moving body as a torpedo or an aeroplane. In the first method he mounted a gyroscope with two instabilities on a body supposed to be stable of itself. The construction and method of mounting was such that the stability of the gyroscope was derived directly or indirectly from the propeller forces. When the body was at rest the stability of the gyrostatic system was not complete; but, when the body was moving, even very slowly, the gyrostat was completely stable, and was then available for steering the body.

A second form of gyrostatic control was shown applied to the production of gyrostatic bicycle riders. When the machine tended to tilt to the left, as seen by an observer viewing it from behind and above, the front wheel was turned to the right of the observer (instead of to the left as in the ordinary machine) and the bicycle was righted by gyrostatic action. This device was said to be available for torpedoes and small aeroplanes.

A method of connecting up the gyrostat to the steering mechanism was described, a very small couple applied by the gyrostat resulting in the application of a very large couple to a vertical rudder at the stern of the torpedo, the couple being applied by means of a geared motor. A third kind of motor-car was shown, consisting of a front part and an after part, the two being connected by means of a vertical hinge. The first part carried a gyrostat and the after part the propelling mechanism. The back portion applied a simple pushing force to the front portion. This system, which would appear on the face of it absurd to the ordinary observer, was completely stable when the gyrostat was spinning and the model was moving forward. The gyrostat detected any tendency to tilt, and obtained from the propeller the forces and momentum requisite to produce stability.

The lecturer also illustrated the application of gyrostatic action to the manipulation of the aeroplane. He proposed to fit an aeroplane with a gyrostatic nose, which would be available forcibly to maneuver the aeroplane. He explained that it would be fairly easy to construct such an aeroplane on a small scale. Elaborate experiments, however, would be necessary, and these were not possible for a private individual. Brought to perfection, such an aeroplane would be invaluable for reconnoitering purposes. It would possess stability in the air, which present-day aeroplanes certainly do not have. It could, as it were, turn on a pivot, and could be raised and lowered in the air by means of forces derived directly from the propellers.

Safer Night Driving for Chauffeurs

SO perfect is the headlight of to-day, that it affords remarkable safety in illuminating the roadway so far ahead as to give more than sufficient time to bring the car to a stop in front of any obstacle. But this very strength of automobile headlights is the thing that has created the second problem. Powerful light ahead, while diminishing the risk of accident for one driver, only increases the danger for a driver coming in an opposite direction. Every motorist knows how he is practically blinded when the glaring headlights of an approaching automobile strike him like a blow in the face. A sensible solution of the problem is the two-color goggle. This solution does not necessitate a weakening of the headlights, or prohibition of their use, or in any sense deprive the driver of the safety afforded by these strong headlights. This goggle has all the features of the ordinary goggle for day driving, with the additional feature of an extra segment in the top of each lens. The main and lower section of the glass is of light amber, and the vision is through this portion for ordinary driving. Above this, in the top of the lens, however, is a smaller segment of darker amber, and when the driver is confronted by dazzling headlights at night, he simply tips his head, to bring vision through this dark segment, which so reduces the glare that the approaching machine and roadway can be seen with perfect clearness. While this extra dark segment was added particularly for strong headlights at night, it has also proven to be a great advantage when driving along seashore, sand, or ordinary roads in the glare of bright sunshine. This dark segment then acts as a shade, or "cap visor," affording protection from the very strong daylight.

French Mistletoe in England

ALTHOUGH mistletoe grows in England, the bulk of that used for Christmas decorations in that country comes from the apple orchards of Normandy. In 1912 the London and South-Western Railway alone handled 1,500,000 bunches, weighing 650 tons and worth $300,000.

Cutting Street Car Rails With Gas

On account of the excessive wear-and-tear on the ends of street car rails, it is frequently advisable to cut away short sections and make replacements. As these rails, especially within city limits, are largely buried beneath the surface, it is desirable to do the cutting with the rails in place. A recent invention permits this service to be performed in an economic and excellent manner. The invention is a portable piece of apparatus, which may be put in place by one man. There are two parts *A* and *B* pivoted above, which may be made to clasp the rail between them, somewhat after the manner of a pair of tongs. These parts have, each of them, a driving mechanism adapted to turn the torch *C* through a large arc in such way that the nozzle will follow the contour of the rail. The driving mechanism is operated by a handwheel above. The two parts of the machine are symmetrical duplicates, so that when the torch has completed its work on one side, it may be detached and put in position on the other part, where it may be driven around the contour of the other side of the rail. The torch is a gas-cutting appliance. That is, it delivers a heating jet of a fuel gas, as acetylene or hydrogen, mixed into oxygen. There is also a second jet of oxygen, which is turned on as soon as the heating jet has sufficiently heated up the work at the point of beginning. The cutting then commences and continues as the compound torch moves around. The heating continually goes on just a little ahead of the actual cutting. This work could be done by hand operation of a suitable cutting torch. The advantage of using a machine, however, is twofold. In the first place, there is gained a very desirable regularity of movement; the torch is carried steadily over its path. Besides, the mechanical method holds the torch, within very close limits, to a predetermined distance from the surface of the work. The second part of the advantage consists in the control of the torch in positions at and below the surface, which would be difficult, if not dangerous, for the human hand to take. Hand operation of a rail-cutting torch would probably result in great waste of gas because of the want of exactness in handling.

The parts *A* and *B* are so pivoted as to clamp the rail between them. The driving mechanism is operated by a handwheel.

The two parts of the machine are symmetrical duplicates, so that when the torch has completed its work on one side, it may be detached and put in position on the other part, where it may be driven around the contour of the other side of the rail.

Cutting street car rails with gas.

The mode of operation is, briefly, as follows: When one of the handwheels is turned, a bevel pinion on the shaft carrying the wheel drives another bevel gear arranged on a second shaft. These two shafts are, when the machine is in place, both in one horizontal plane. One is perpendicular, however, to the other. The second shaft carries a worm which engages a wormwheel arranged on a shaft oblique to the horizontal plane. This third shaft runs down into one of the clover-leaf cases seen in the photographs. By a system of bevel and spur gearing, this third shaft transmits its drive alternately to a shaft perpendicular to the surface of the paper, on which shaft the torch is secured. The entire drive from the handwheel to the shaft for the torch provides for just two principal things: (1) reduction in rotary speed, and (2) rotary operation of the shaft holding the torch.

The torch is secured to its shaft by means of a slide lying in a vertical plane transverse to the web of the rail. At one end of this slide is the torch; at the other, a roller or traveler in contact with a cam track. While the turning movement is being accomplished, the roller rolls against the cam track, the result being that the nozzle of the torch follows accurately the contour of the rail, beginning, say, beneath the outer edge of the upper flange, then working in toward the web, then turning to follow the fillet between flange and web, then working down the web to the lower fillet, around it and out to the outer edge of the lower flange. Different cam tracks provide for different contours. The oblique shaft belonging to the opposite half of the machine is driven by a bevel-gear arrangement connecting the two oblique shafts. The two oblique shafts accordingly turn in opposite directions. The arrangements are such that if two torches be secured simultaneously in place, both will move downward together and upward together. Such a machine may be operated by a comparatively unskilled workman, once the proper adjustments have been made. It may be moved from point to point on a small hand truck, together with the tubes containing the gases. The amount of earth that has to be removed to permit of operation is small in amount. Only a little has to be taken out beneath the rail.

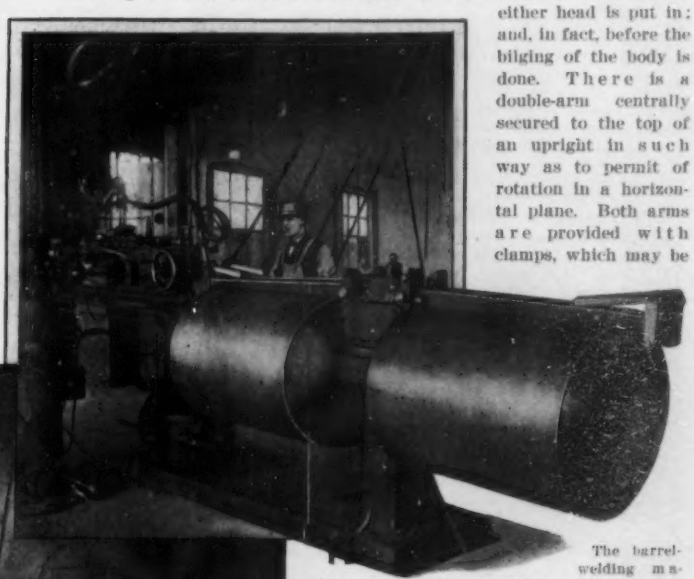
A double arm is centrally secured to an upright so as to permit of horizontal rotation.

The welding of steel barrels.

The seam is welded before either head is put on.

Welding Steel Barrels With Oxy-acetylene Torch

In the manufacture of steel barrels, the longitudinal seam constitutes a principal problem. It is very essential that this seam be one not subject to leakage. A barrel filled with a liquid of the same specific gravity as water will have, at the bottom of the seam, an internal pressure of about one pound per square inch. If the liquid is as fluid as, or more fluid than, water, there will be a considerable tendency to leak. When it is borne in mind that it is desirable to bilge the barrel body after the seam has been made, the difficulty of getting the best results will become still more apparent. It has now been found that a gas-welded seam will prove satisfactory, if sufficient care is exercised in making it. But to depend upon the skill of the welding operator and to give the time necessary for hand operation would make the gas-welding solution of the problem only moderately successful. Accordingly, a machine has been devised which accomplishes in half the time, with comparatively unskilled men, the results of highly skilled labor. The barrel-welding machine consists of two parts: (1) a holding device which maintains the work in a fixed and accessible position; and (2) an apparatus which carries two torches over the path of the seam. This latter is power drawn. By suitable arrangements, provision is made for a considerable range of speed, thus permitting a variety of weights of sheet metal to be handled. The seam is welded before either head is put in; and, in fact, before the bilging of the body is done. There is a double-arm centrally secured to the top of an upright in such way as to permit of rotation in a horizontal plane. Both arms are provided with clamps, which may be locked in position so as to secure the unwelded body firmly in position. The body on one arm is welded by the power-drawn holder of the two torches. While this is going on, the welded body on the other arm is released by an attendant, and an unwelded body put in position. When the welding on the first arm has been completed and the welding apparatus backed out of the way, the double-arm is swung round through an arc of 180 degrees, when welding begins anew. In this way, the machine is operated almost continuously. Two men are required—one on the welding side. When a certain weight of work is to be handled, a skilled operator or the foreman or some other high-priced man will settle upon the sizes of torches, upon their exact positions, and upon the rate of movement. These matters determined, a comparatively cheap man can run the machine. The man who takes off and puts on bodies is an ordinary helper. A typical barrel body will be a sheet of steel three thirty-seconds of an inch thick, bent to form a hollow cylinder. The edges will have been previously prepared by an upsetting or other operation, so that when brought together, edge to edge, there will be an excess of metal on both sides. The excess desired is very slight. It is needed because the machine operates without the use of welding rods. All the metal that is used is already in the work. This elimination of the welding rod solves at one stroke an otherwise difficult problem. When the fresh material needed to close up the joint is provided the exact amount and exact position of the new material are both cared for effectively.



The barrel-welding machine consists of two parts: (1) a holding device, which maintains the work in a fixed and accessible position, and (2) an apparatus which carries two acetylene torches over the path of the seam.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

GARMENT HANGER.—A. BUCHWALD, care of Isidor Frank, 1675 Madison Ave., New York. This hanger consists of a cardboard blank bent to form a head and chest with a hook projecting from the head. The bent chest portion of the hanger holds the chest portion of the garment out in normal position, while the head of the hanger indicates the proportion and style of the garment, relatively to the bust of a normal person.

Electrical Devices.

CONNECTING CLIPS FOR ELECTRICAL CONDUCTORS.—J. G. ELKIN, care of Manhattan Motor Co., 68-72 E. 131st St., New York. The clip here illustrated may be securely fastened to insulating conductor wire, enabling it to be quickly and conveniently attached to or detached from a binding post or the like. It

CONNECTING CLIPS FOR ELECTRICAL CONDUCTORS.

consists of a pair of spring-pressed jars pivotally connected and a clamp on the pivots of the jars, adapted to engage the bare end of the wire conductor, together with means for closing or opening this clamp.

TELEGRAPH RECEIVER.—A. PAROBI, 38 Macdougall St., New York. The invention relates to telegraph receivers producing a record adapted to actuate mechanism whereby messages may be received through the sensations of hearing and sight. The primary object of the invention is the provision of a telegraph receiver adapted to record messages on a continuous tape, the construction being characterized by a new and improved means for feeding the tape.

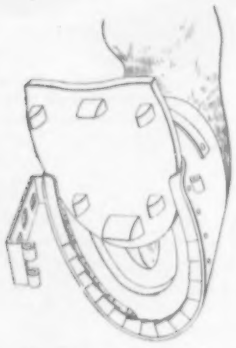
Of Interest to Farmers.

GATE OPENING MEANS.—H. SOMERS, Armstrong, British Columbia, Canada. The invention relates to operating means for road gates, designed to be operated by a driver or equestrian, to open the gate and then to close the gate after having passed through. The mechanism is such that it may be operated from either side to cause the gate to open away from the operator.

PULVERIZER.—J. C. MIRE, Dreyfus, La. Mr. Mire's invention consists of a pulverizer especially adapted for pulverizing the soil in the furrow. It is designed to be attached to a turning plow to pulverize the soil as it is turned. It comprises a bar having laterally extending arc-shaped teeth, which gradually increase in size from one end of the bar toward the other.

Of General Interest.

OVERSHOE FOR HORSES.—MABEL BLACKMAN, 204 West 52nd St., New York. The invention provides an overshoe for horses which may be easily adjusted to the hoof of the horse. The overshoe is provided with remov-



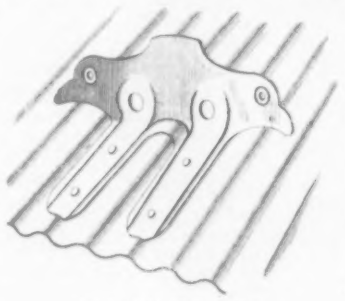
OVERSHOE FOR HORSES.

able soles formed with calks arranged to prevent slipping. The calks may be made of a material that will not injure pavements and yet will furnish a good footing under all conditions.

ANTI-FREEZING OUTLET VALVE FOR TANK.—J. W. WHIPP, care of L. D. Ratcliff, Decatur, Texas. In cold weather much difficulty is experienced with the outlets of tanks and the like which are apt to become frozen. This is obviated in the present invention by providing an air space about the valve stem so that no water comes into contact with the stem or rod at the level of the water in the tank.

VENTILATING SHOE OR SLIPPER TREE.—W. A. NICKLESS, care A. Steinhardt & Bro., 860 Broadway, New York, N. Y. In order to ventilate the shoe or slipper thoroughly and prevent undue shrinking of the leather this tree is made with a toe or a vamp form having longitudinal passages beginning at the back of the form and extending forwardly and vertical passages intersecting the longitudinal ones and extending from the bottom of the form to the arched top thereof.

SNOW GUARD FOR ROOFS.—A. DANZER, Hagerstown, Md. The snow guard consists of a plate metal piece rolled to the form shown in the illustration. It may readily be attached



SNOW GUARD FOR ROOFS.

to a roof. Preferably it is used alone, but if desired a bar or board may be secured to the upper side of the plate by means of screws inserted through the holes in the plate.

Heating and Lighting.

ATTACHMENT FOR GAS METERS.—J. G. HAYDEN, New Lexington, Ohio. In order to remedy the offset caused by shrinkage or expansion of the diaphragms in meters which depend on the pull of a diaphragm to operate a planetary valve controlling the passage of gas through the meter, the present invention provides an adjustment of the valve operating mechanism to compensate for the variable amplitude of swing of the actuating diaphragm.

PROCESS FOR PRODUCING COMPRESSED AIR OR COMPRESSED GAS ESPECIALLY FOR OPERATING OF LAMPS.—W. LIEBKE, 17 Grolemannstrasse, Berlin-Charlottenburg, Germany. This process of compressing air or gas for feeding lamps consists in vaporizing quicksilver, ejecting the vaporized quicksilver into a body of air or gas to force the latter along with the vapor into a reservoir to compress the same therein, and conducting the compressed air or gas to the lamp.

Household Utilities.

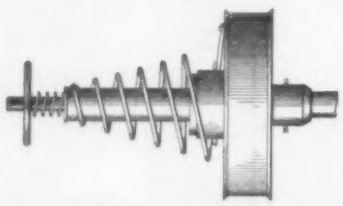
TRAY.—M. B. SOLOMON, care of American Tray Co., 233 Mercer St., New York, N. Y. The purpose of the inventor is to provide a tray arranged to permit of conveniently assembling the tray, bottom, frame and railing and fastening the same together without resorting to soldering, at the same time forming an exceedingly strong tray which is also neat and ornamental.

DRIP WATER SAFE.—J. J. HICKEY, 2130 Lexington Avenue, New York, N. Y. The invention relates to sanitary engineering and has particular reference to improvements in plumbing apparatus associated particularly with iceboxes, refrigerators or the like. It provides a very simple drip water reservoir or safe for refrigerators which may readily be applied to or removed from the main waste pipe without the use of tools.

CREASING IRON.—H. W. POGUE, 1745 North Church St., Decatur, Ill. The invention relates to irons for creasing trousers, coats and other garments, and provides the iron with opposed members between which the portion of the garment to be creased is received, the members being provided with guiding runners to assist the user in guiding the iron.

Machines and Mechanical Devices.

TRANSMISSION DEVICE.—J. W. HOWERY, Darlington, Wis. The invention provides a transmission device with an interposed spring, affording a cushion between the driving pulley



SHOCK-ABSORBING PULLEY.

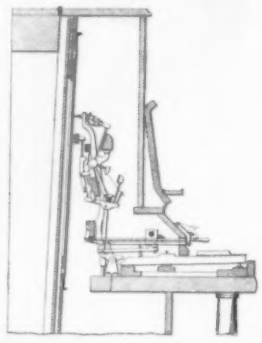
and the shaft actuated thereby. It is particularly useful in driving cream separators or dynamos requiring very steady speed, and may be employed with an internal combustion engine, to absorb the shock due to the periodic explosion.

SAW SHARPENER.—P. HILSINGER, Killawog, New York. The inventor aims to improve the construction of saw sharpeners and increase their efficiency without unduly complicating the mechanism employed. With the improved device the handling of the saw is greatly facilitated and the placing of the saw teeth for the purpose of operating upon them is rendered specially accurate.

FIBER SEPARATING MACHINE.—M. E. PARKS, Box 541, El Paso, Texas. The invention relates particularly to a machine in which the separating element travels faster than the feed crushing roll, but slower than the drawing roll, so that the butt end of the plant stock can be effectively acted upon by the separating element, there being coacting endless devices which carry tools to remove the bark, pulp or other matters from the fiber.

Musical Instruments.

TRANSPOSING DEVICE.—J. VACCARO, deceased; PIETRO VACCARO, administrator, 79 Franklin St., Bristol, R. I. In order to permit of playing a piece on the piano a half tone, whole tone, or several tones higher or lower than the one to which the piano is ordinarily tuned, a shiftable connection is inter-



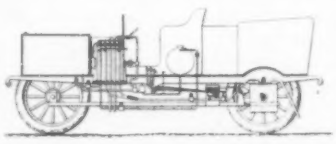
TRANSPOSING MECHANISM FOR PIANOS.

posed between the keys and the abstract of the piano action. A locking device is provided for engaging the rear ends of the keys to hold them in lowermost position, and the operating means for this locking device forms a locking device for the shiftable connection.

Prime Movers and Their Accessories.

CARBURETER.—L. R. MILLER, JR., Dodge City, Kansas. Mr. Miller has for his object in this invention to provide an improved carbureter having a movable mixing tube, so shaped and moved that it acts as a throttle and is connected to the usual throttle operating mechanism and is operated in the same manner as the throttle is operated.

VEHICLE POWER PLANT.—E. F. HOWE, El Centro, California. To provide a simple transmission between the motive power generator and the wheels of an automobile, Mr. Howe has invented a vehicle power plant, gen-

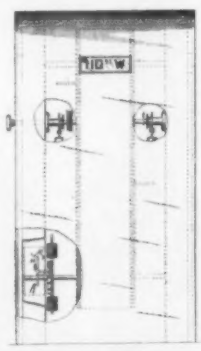


POWER PLANT AND TRANSMISSION FOR AUTOMOBILES.

erating and using compressed fluid, which does not require a large number of mechanical elements for its transmission. The plant comprises a rotary explosive engine, a fluid compressor and a reversible fluid motor for propelling the vehicle.

Railways and Their Accessories.

STREET INDICATOR FOR CARS.—F. H. WEBSTER, Marvell, Ark. The invention provides a street indicator in which the names of successive streets are printed upon a band which is moved by a step by step mechanism. When a car passes a street, the name of which is not to be displayed, such name

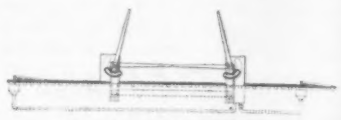


STREET INDICATOR FOR CARS.

will be practically skipped, although it may be carried upon the band. An automatic reversing mechanism comes into play when the car reaches the end of its route and starts upon its return trip.

RAILWAY-SPIKE.—L. WECHSLER and E. SCHERER, 19 West 118th St., N. Y. The shank of the spike is divided into a number of points adapted to be deflected outwardly and upwardly when forced into a railway tie. A spreading member is provided which is adapted to fit in a bored out socket in the tire so as to cause the points to be deflected with the least possible mutilation of the wood.

AUTOMATIC RAILWAY GATE.—H. GORMLEY, 206 W. 131st St., New York, N. Y. Hydraulically operated gates for railroad crossings, adapted to be automatically closed before an approaching train and opened after the train has passed, are provided by this invention. The mechanism comprises a pair of inter-communicating cylinders of different diameters, the plunger of a larger cylinder being

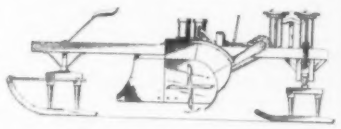


AUTOMATIC RAILWAY GATE.

adapted to be engaged by a vehicle moving on the track, while the smaller cylinder is fitted with a plunger that operates the gate.

Vehicles and Their Accessories.

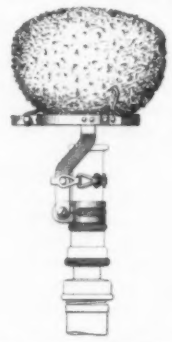
SNOW PLOW.—W. L. STADIG, St. Francis, Maine. This invention provides co-acting means for taking up the snow and causing it to be raised and deflected to the side of the road. It removes snow from highways, logging roads,



IMPROVED SNOW PLOW.

and the like. It provides means associated with the rotary elements, and adapted to gather the snow to the latter, the said means being arranged for adjustment to the road level, or to leave a "comb" in the road center.

WASHING DEVICE FOR AUTOMOBILES.—H. T. FORD, Central Valley, N. Y. The invention consists of a sponge-holder which may



WASHING DEVICE FOR AUTOMOBILES.

readily be applied to the nozzle of a hose, for washing an automobile, so that the sponge will be directly in line with the stream of water issuing from the nozzle, and may, when desired, be thrown out of this stream, to permit the stream to be played directly upon the parts to be wished.

Designs.

DESIGN FOR A VEHICLE FRAME.—J. WORKSMAN, 39 S. Main St., Asbury Park, N. J. The design covers a frame of rectangular form coupling two bicycle forks. The frame is attached to the heads of the forks, while there is a spacing member secured to the forks at their lower end, and diagonal bracing members running from the head to the center of the spacing member.

DESIGNS FOR TUMBLERS, GOBLETS, JUGS, OR SIMILAR ARTICLES.—W. E. HUNTER, care of Economy Tumbler Co., Morgantown, W. Va. Mr. Hunter has obtained three patents on ornamental designs for tumblers, goblets, jugs, and the like. The designs consist of ornamental bands adapted to be run around the body of the vessel. One of the designs provides for a band of leaves interrupted at intervals by a conventional figure and a spray of flowers. A second design consists of a conventional chain or rope effect, under which there is a wavelike band. The third design consists of a band made up of conventional flowers in the form of scrolls, with a band of leaves above and a draped effect below.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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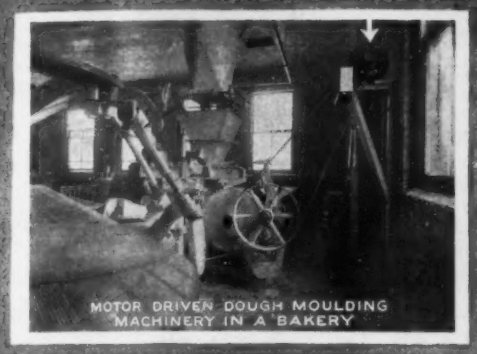
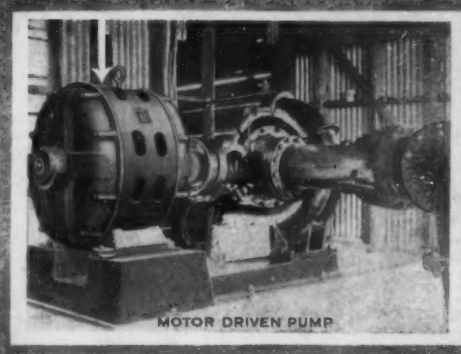

MOTOR DRIVEN DOUGH MOULDING MACHINERY IN A BAKERY

W
WESTINGHOUSE ELECTRIC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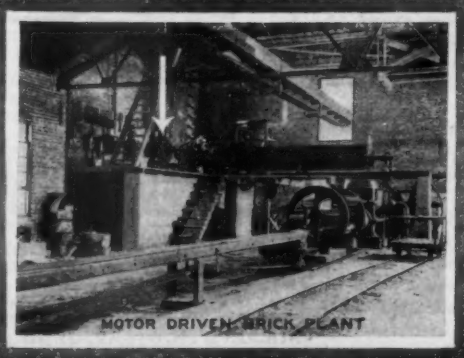
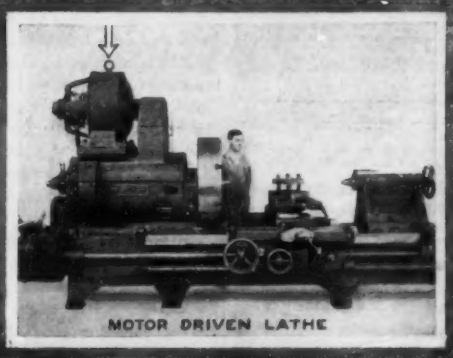
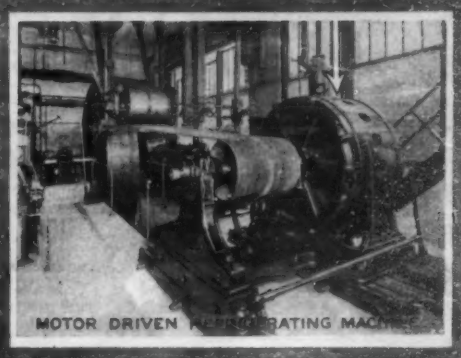

MOTOR DRIVEN BRICK PLANT


MOTOR DRIVEN LATHE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In every Bell telephone—8,000,000 of them throughout the United States—you see the product of this company. Thousands more are used by other telephone companies and on private systems. Western Electric telephones are also standard on many of the foreign telephone lines.

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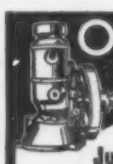

Height of engine 15 inches; weight of engine 45 lbs. Can be carried in a suit case.

Just the thing for running a lathe, drill, saw, ice cream freezer, washing machine, fan, sewing machine, auto air pump.

This engine fills a long felt want. No workshop is complete without power and no workshop can afford to be without power when the EMPIRE can be purchased for almost nothing. A child ten years old should learn to operate it in thirty minutes.

Description The EMPIRE is a two-cycle, jump spark engine. It is made along simple and practical lines so that it is not difficult to handle. The crank shaft is made of best drop forge steel. The piston has two rings, being also made of the best obtainable material. The water hopper is of ample capacity to keep the engine at the proper running temperature. The fuel is kept in the base of the engine and is mixed with the lubricating oil, this doing away with unnecessary sight-feed oilers, at the same time insuring proper lubrication. The speed is variable, from 300 to 1000 R.P.M., and can be changed while the engine is in motion. Engine shipped complete, including batteries, spark coil and all equipment necessary to operate.

Guarantee We unconditionally guarantee that every pound of material used in the EMPIRE 3-4 H. P. is free from defect in material or workmanship, and will replace any time within three years from date of purchase any parts showing defect from either cause above stated.

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Analytical Comparison of the Bird and Monoplane.

(*Concluded from page 460.*)

retained without employing the treacherous wire.

The control of the machine is very simple. The ascent is made by pushing downward and forward on the steering-wheel; the descent by pulling the wheel backward and upward. Steering from right to left is accomplished by turning the wheel from right to left, similarly to steering an automobile. Lateral balance is gained by operating a second wheel in conjunction with, or independent of, the steering-wheel.

The landing chassis is very simple, composed of two wheels and a skid. The wheels are mounted on V-shaped members and suspended on twin coil-springs, lying parallel with the body of the machine. After leaving the ground the wheels are folded upward and inward, disappearing through apertures in the body of the machine, which are closed by sliding doors. The wheels are folded by worm-gears operated by the feet of the aviator.

Three-bladed propellers are employed. The motor turns 1,000 revolutions per minute, while the propellers turn 750 revolutions per minute. Propellers are mounted on the entering edge of the main planes, five and one half feet from the sides of fuselage. This plan gives the tractile power at the points most needed.

The seat of the observation officer can be turned from side to side or raised or lowered, similar to a piano stool. This method of mounting the seat affords a wide scope of vision. The machine-gun of demountable form, which may be raised or lowered or turned from side to side, is mounted on the cowl, directly in front of the observation officer. Two port-holes are built in the bottom of the fuselage just below the pilot and observation officer. These openings afford a splendid view of the underlying country. Bombs may be dropped, the machine-gun fired, and pictures taken through them. These port-holes can be closed with sliding steel doors when necessary, for protection from the enemy. The machine is fitted with regulation wireless outfit. The electricity is supplied by a generator and storage battery, which also supply the searchlights when flying at night. A small rain-vision wind-shield is fitted to the cowl just in front of the occupants, which gives good protection during high speed and stormy weather. Gas and oil tanks are mounted between the pilot and motor over the center of pressure, according to standard practice. Rubber rope or chain is used to transmit the power from the motor to the propellers. Generous sized air-cushions are used to upholster the seats and cock-pit of the fuselage. These will protect the aviator and passengers in case of a hard landing. All instruments that assist the aviator are placed directly inside the cowl in front of the pilot.

Weaving Real Persian Rugs

(*Concluded from page 464.*)

a pile thread i is left dangling between the warp threads a, a^3 in front of the crossing a^2. The warp threads a, a^1 are now returned to normal position, as shown in Fig. 5, whereby the loose end of the pile thread i extends downwardly on the outside of the warp thread a, is looped over the warp thread a, passes between the warp thread a, a^3 and around the other warp thread a^1 to then extend upward on the outside of this warp thread a^3. The tuft yarn tube h is now again passed downward between the now parallel warp threads a, a^1, as shown in Fig. 6, to complete the Persian knot, and while the tuft yarn tube h is in this lowermost position, the pile thread is cut by a transversely moving knife k, after which the tuft yarn tube h rises to uppermost position. One, two, or more weft or binding threads l are now passed through the opened shed and the Persian knot and weft thread are beaten home by the lay.

The selection of the yarn tubes carrying the differently colored pile threads i is made by the overhead Jacquard mechanism, the perforate cards of which may

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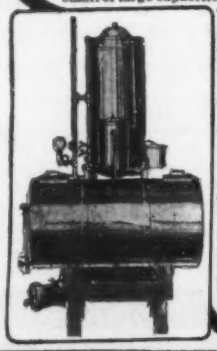

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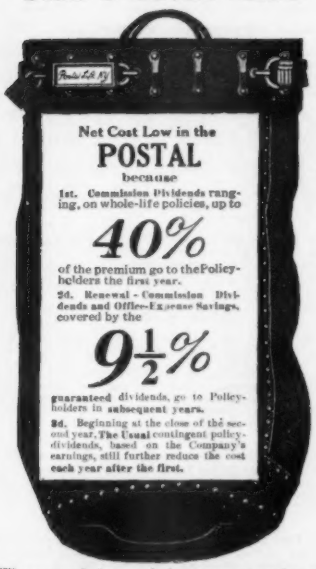
The Postal Life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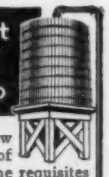

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be regarded as equivalents of the *talim* sheets used by the Oriental weavers. The loom is wholly automatic, and at each operation, as above described, a whole row of pile knots is made, corresponding in color to a predetermined design.

What a very industrious Oriental weaver can weave in about a year this loom accomplishes in a single day, and consequently the product made by this loom can be sold considerably cheaper than the hand-made product, considering the quality of the material as being alike.

The power loom shown in our illustration weaves a rug 10½ feet wide and of any length, according to the design. It was built by the Crompton and Knowles Loom Works, whose faith in the invention was largely instrumental in achieving success.

The importance of this invention of Mr. Dalkranian was early recognized by the late Mr. Nazar Costikyan, founder of the well-known firm of Oriental rug importers, Costikyan Bros. & Co., of New York city, and through Mr. Costikyan's financial assistance and that of his son, Mr. Mihran N. Costikyan, the inventor was enabled to reduce his invention to practice.

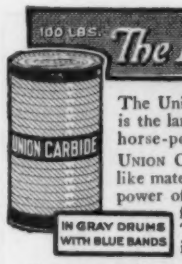
Summary of the Eighth Report of the Carnegie Foundation for the Advancement of Teaching.

THE eighth annual report of the president of the Carnegie Foundation for the Advancement of Teaching, shows a total endowment of $15,325,000, and an expenditure for the year ending September 30th, 1913, of $658,431. Of this $519,440 was distributed in retiring allowances to professors, and $80,949 in pensions to their widows, a total of $600,389. Thirty-three allowances were granted during the year, making the total in force 405, the average annual payment to an individual being $1,703. The total distribution from the beginning has been $2,936,927. The educational work of the Foundation was separately endowed in January, 1913, by a gift of $1,250,000 from Mr. Carnegie through the Carnegie Corporation of New York. This body, which is endowed with one hundred and twenty-five million dollars for "the advancement and diffusion of knowledge and understanding," has five *ex-officio* trustees, of whom one must always be the president of the Carnegie Foundation for the Advancement of Teaching.

In connection with the Foundation's work as a center of information concerning pensions, the president discusses pension systems that are maintained by half a dozen colleges, the development of new systems at Brown University, the Rockefeller Institute, and the American Museum of Natural History, the new federated pension system of the English universities, and the proposed system for the clergy of the Episcopal Church. Among pensions for public school teachers the report discusses the misfortunes of the New York city system, and commends the plans of the new State system in Massachusetts.

Much of the report is devoted to the development of the educational work of the Foundation into a separate Division of Educational Inquiry. Its recent work includes a study of education in Vermont at the request of the Vermont Educational Commission, of legal education at the request of a committee of the American Bar Association, and of engineering education at the request of a joint committee representing the national engineering societies.

The study of education in Vermont, already distributed, represents the first survey that has been made of a State's educational activities as a whole. The study of legal education has been begun by a first-hand inquiry into the bar examinations of every State, a special study of legal teaching by Prof. Josef Redlich, who came from Vienna for the purpose, and by a personal examination of each of the 160 law schools in the country. Plans for the study of engineering education are now being completed. The earlier educational work of the Foundation is continued in the report by commendation



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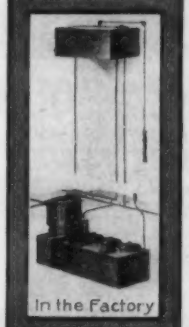
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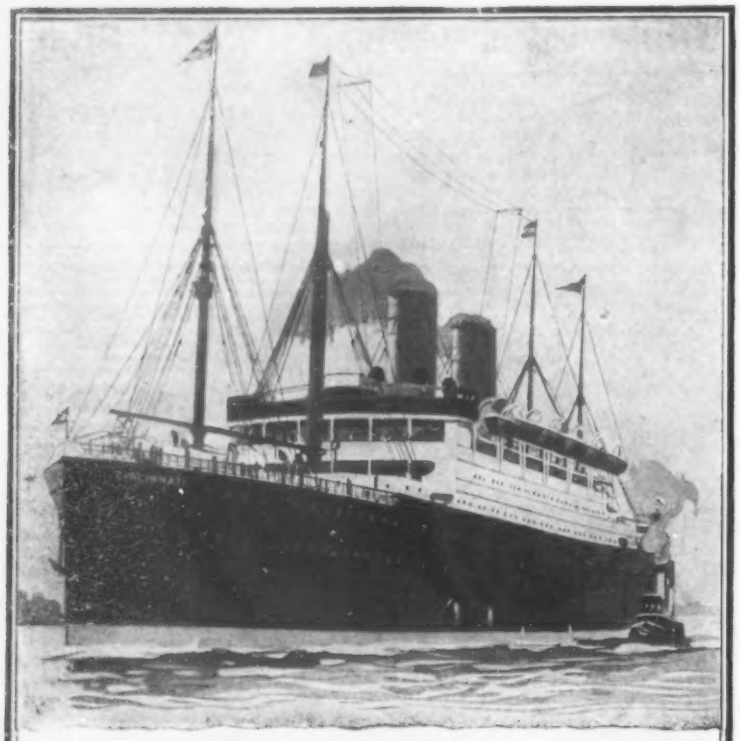

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of the present tendency of college entrance requirements toward both elevation and flexibility. The need for further improvement is shown by the fact that only 55 per cent of the students now in our colleges are high-school graduates. The decrease in the number of medical schools in the country from 162 in 1910 to 115 in 1913, and the rapid improvement of the better schools are commented upon with appreciation. A general study of the problems of the State regulation of higher education is illustrated by a detailed account of the recent crisis in educational affairs in Iowa.

The report further presents a study of the financial status of college teachers as compared with the situation presented in a similar study published five years ago. The ordinary salary of a full professor in the institutions associated with the Foundation is now $3,000. During the last five years the salaries of instructors have risen by about $80; those of junior professors show a gain of from $120 to $225; those of full professors show an increase from $125 to $350.

The report concludes with a frank criticism of contemporary college catalogues. It is accompanied by the annual report of the treasurer.

Alum in Foods

THE much-mooted question of the effects of aluminium compounds on the nutrition and health of man forms the subject of a recent report by the Referee Board of the U. S. Department of Agriculture, the substance of which is published as Bulletin No. 103 of that department. The conclusions of the board are supported by the results of three sets of extensive experiments on human subjects, conducted independently by Dr. Russell H. Chittenden, of the Sheffield Scientific School; Dr. Alonzo E. Taylor, of the University of Pennsylvania Medical School; and Dr. John H. Long, of the Northwestern University Medical School, all of whom are members of the board. Although alum is used in making pickles, preparing maraschino cherries, etc., the amount that thus enters into human diet is very small compared with that consumed in baking powders; hence the attention of the board was directed chiefly to the effects of alum baking powders. It appears that "a saline cathartic residue results from the reaction of every known form of baking powder now commonly employed," and when such powders are used in large quantities—e. g., when a person subsists mainly on baking-powder biscuits, as may happen in camp life—the cathartic effect would be noticeable and ultimately injurious. On the other hand, the amount of such powders used in an ordinary domestic diet is found to have no such effect, and does not in any way impair the nutritive value of foods. "In short, the board concludes that alum baking powders are no more harmful than any other baking powders, but that it is wise to be moderate in the use of foods that are leavened with baking powder."

A Remarkable Series of Synoptic Weather Charts, showing the meteorological conditions over the southern hemisphere south of latitude 30 S. for each day from October 1st, 1901, to March 31st, 1904, has just been published by the Royal Society of London as a volume of the scientific results of the National Antarctic Expedition of 1901-04. The data on which these charts are based were gathered from vessels of all kinds, including exploring ships, as well as from the meteorological observatories and stations of the lands surrounding the Southern Ocean, and cover about one quarter of the earth's surface. No such charts have ever before been published for the southern hemisphere. Their preparation has been in progress for eight years at the Meteorological Office, in London, under the direction of Commander Campbell Hepworth, marine superintendent.

The War Department is reforesting a large area near Fort Bayard, New Mexico, for use as an army hospital site.

LEGAL NOTICES

PATENTS

If you have an invention which you wish to patent you can write fully and freely to Munn & Co. for advice in regard to the best way of obtaining protection. Please send sketches or a model of your invention and a description of the device, explaining its operation.

All communications are strictly confidential. Our vast practice, extending over a period of more than sixty years, enables us in many cases to advise in regard to patentability without any expense to the client. Our Hand Book on Patents is sent free on request. This explains our methods, terms, etc., in regard to PATENTS, TRADE MARKS, FOREIGN PATENTS, etc.

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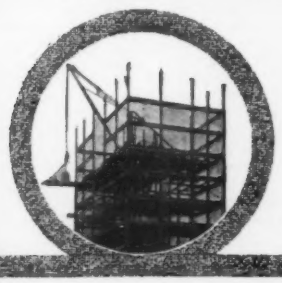

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See Sweet's Catalog, 1914 edition, pages 1916-1917

NEW BOOKS, ETC.

ON OLD WORLD HIGHWAYS. A Book of Motor Rambles in France and Germany, and the Record of a Pilgrimage from Land's End to John o'Groats in Britain. By Thomas D. Murphy. Boston: L. C. Page & Co., 1914. 8vo.; 388 pp.; 16 color plates and 40 duogravures. Price, $3 net.

A most attractive travel book comes to us under the title "On Old World Highways." By far the larger portion of the book is devoted to Great Britain; here the author's treatment becomes most intimate and sympathetic, and we are given some very fine reproductions in color from such canvases as those of MacWhirter and Moran. The viewpoint is one that makes especial appeal to the motorist who is educated, or at least interested, in historic and picturesque values, but much practical suggestion as to roads, hotels, etc., is embodied in the text. There is a large outline map of France and Germany, and others of England and Scotland. The final chapter on "The English and Their Institutions" is sketchy and vigorous rather than profound, but it will serve to correct some prevailing impressions as well as to offer a word of warning to American motorists who have occasion to patronize wayside repair shops.

HYDRAULICS. A Text-Book for Students and Engineers. By Ernest H. Sprague, A.M. Inst. C.E. New York: D. Van Nostrand Company, 1914. 12mo.; 184 pp.; 89 illustrations. Price, $1 net.

Many of the accompanying diagrams are very crude, though not sufficiently so to be obscure. The text, compiled from standard treatises and lecture notes, is well arranged, and all important principles are ably covered. The author does not scruple to use the calculus wherever convenient; he even hopes that its inclusion may prove of advantage in familiarizing the student with its advantages and in removing the exaggerated fear which the tyro exhibits toward this most important instrument of analysis.

ECHAPPEMENTS D'HORLOGES ET DE MONTRES. Exposé Technique, Descriptif et Historique, des Echappements d'Horlogerie. Paris: Bureau de l'*Almanach de l'Horlogerie-Bijouterie*. 8vo.; 263 pp.; illustrated. Price, francs, 4.

This latest volume from the press of Charles Gros is an exhaustive description, from both historical and technical points of view, of those delicate and ingenious mechanisms known as escapements. Every detail of the various types is shown in the 275 cuts that enrich the exposition. Inventors will find a study of the movements and combinations of distinct aid in their work.

PROGRESSIVE CHEMISTRY. Practical Experiments for Secondary Schools. Prepared by the Teachers of Chemistry in the High Schools of Minneapolis, Minn. Price, 35 cents.

The authors present their material in the form of a writing pad. The upper part of each page is devoted to instructions for carrying out the various simple experiments. The lower portion of the page is blank, for the equations and results of the student. The index shows some forty captions, including tests of water and milk, the determination of simple unknowns, litmus tests and neutralization.

THE FUNDAMENTAL BASIS OF NUTRITION. By Graham Lusk. New Haven: Yale University Press, 1914. 12mo.; 62 pp. Price, 50 cents net.

Prof. Lusk's little book furnishes the clearest exposition we have seen of food values and their relation to the cost of living. The chief aim of the work seems to be to enable the family of small income to select the foods highest in nutriment at the lowest expense. The chapter on beri-beri is in the nature of a digression from this purpose, and it might have been well to have given in its stead a brief discussion of the correct principles of preparing food for the table. So much depends upon the conservation of certain elements, and the bringing out of flavor, that no book on nutrition is complete without some warning of the changes that poor cookery produces in the nutritive values of food.

BAU, UNTERHALTUNG UND VERTEIDIGUNG DER FLUSSDEICHE. Von Ehlers, Geheimer Baurat, Professor an der Technischen Hochschule Danzig. Berlin: Wilhelm Ernst & Sohn, 1914. 8vo.; 54 pp.; illustrated. Price, 3.20 marks.

In bringing out this work, the publishers give us another authoritative and valuable discussion. Dikes, levees, and revetment work are made plain by a profusion of charts and diagrams. The control of river water is studied under varying aspects and conditions, and successful constructions are presented for the reader's consideration.

FORGED EGYPTIAN ANTIQUITIES. By T. G. Wakeling. London: Adam & Charles Black, 1912. Price, $2 net.

Mr. Wakeling's book makes entertaining reading, and will no doubt serve the purpose of placing amateur collectors on their guard. It does not attempt to give positive instructions as to the best manner of detecting frauds, but rather to present its information by citing examples of actual cases of fraud which have come to the author's attention.

INDIA-RUBBER LABORATORY PRACTICE. By W. A. Caspari, B.Sc., Ph.D., F.I.C. New York: The Macmillan Company, 1914. 12mo.; 196 pp.; illustrated. Price, $1.50 net.

This text is a compendium of practical analytical methods, every one of which has been used by the author, and is vouched for by him as pro-

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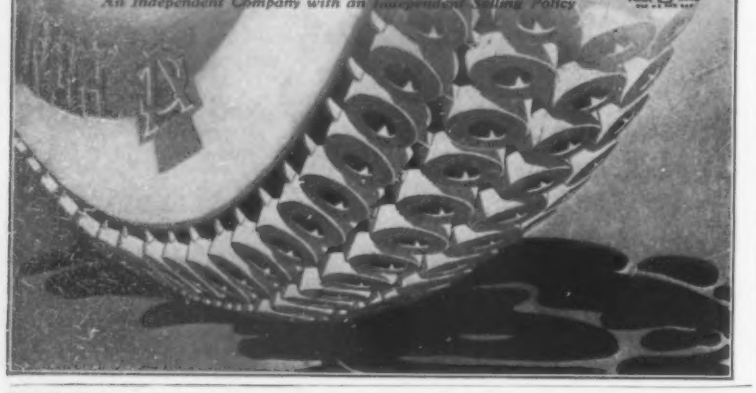

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ductive of satisfactory results. The botanical side of the subject has been practically omitted, as have theoretical chemistry, the production of raw material, and mechanical tests of the finished product. In the special field which it covers, the work will furnish valuable aid to the chemist called upon to deal with India-rubber. Among significant chapters may be noted those on diluents, solid compounding materials, accessories, specific gravities, and analyses of manufactured rubber—both organic and inorganic. Several useful tables are appended.

FLYING. Some Practical Experiences. By Gustav Hamel and Charles C. Turner. New York: Longmans, Green & Co., 1914. Price, $3.50 net.

Mr. Hamel and Mr. Turner have written the kind of book which one has the right to expect from practical airmen. It gives us just that insight into the life of a pilot which most works on aeronautics have ignored. That flying is still more or less an acrobatic performance would seem to follow from Mr. Hamel's insistence upon good health and good physical condition. He is one of the few aviators that we know who frankly confess that exceptional steadiness of nerve and extraordinary coolness are indispensable elements in the personal equipment of every airman. It is a pleasure to see that the subject of accidents is not glossed over. Mr. Hamel unscathingly denounces pilots who leave everything to their mechanics and who take desperate chances. Particularly instructive is Mr. Hamel when he speaks of the vagaries of the air. "The air is so sensitive," we learn, "that it is affected even by the color of large patches of vegetation." Mr. Hamel has no illusions about the efficiency of the flying machine and particularly of the hydro-aeroplane, as we now know it. "It is highly probable that all the sea-flyers tried in public hitherto are doomed to extinction," he tells us. "The efficient sea-plane is certain to be evolved. Meanwhile no nation possesses it." He bears out the views of the best designers when he says, "Beyond a general belief that all existing float contrivances are unsatisfactory and that a real airboat must be evolved, no one is able to foretell what will be done." While one may take issue with such rash statements as "there is not an aeroplane in the German military service that is not equipped with a bomb magazine and an instrument for sighting and timing," we must commend the book on the whole as a valuable addition to aeronautic literature.

PATENTS FOR DESIGN. By William L. Symons, LL.M., Member of the Bar of the District of Columbia, Lecturer on the Law of Trade-Marks and Patents for Designs, Washington College of Law. Washington, D. C.: John Byrne & Co., 1914. 134 pp. Price, $3 net.

The rapidly increasing importance of the subject of design patents requires that more attention and thought be directed to that branch of law and Patent Office practice confessedly not yet well settled and understood. The need for a treatise in which the provisions of the statutes, regulating the issuance of design patents and the subsequent enforcement of the rights acquired under them, are analyzed and considered in the light of Court and Patent Office decisions, has been supplied by the author. The text is arranged under six main headings, into which this subject can be logically divided for easy reference and study, as follows: Design Patent Statutes, Subject Matter for Design Patents, Invention, Novelty and Infringement, Applications and Letters Patent, and Procedure in the Patent Office. Under each of these headings, or main divisions, the author has carefully selected and grouped a large number of leading and decisive decisions rendered by the courts and the Patent Office, with a clear and full discussion and analysis of the most important of these. In grouping the decisions which are controlling on one or another feature of Design Patent Practice, the author was guided by the belief that the opinions expressed by the courts and writers on this subject, if held up and examined side by side and the exact points of existing differences noted, would lead to a clearer and better understanding of the particular questions involved. This book is but the third of its kind published in this country, the second appearing in 1889, of which Hector T. Fenton, Esq., of the Philadelphia Bar, was the author. The pioneer work was written and published in 1874 by William E. Simmonds, former Commissioner of Patents. There can be little doubt but that "Patents for Design" will meet with favor at once, and that it will be of inestimable value to all interested in its subject matter.

LA LUMIÈRE ELECTRIQUE ET SES DIFFERENTES APPLICATIONS AU THEATRE, installation et entretien. Par V. Trudelle, électricien. H. Dunod et E. Pinat, Editeurs, 47 et 49 Quai des Grands-Augustins, Paris, VI. In-8 de vi-295 pages, avec 80 fig. Broché, 10 francs; Cartonné, 11 fr. 50.

M. Trudelle has written a very practical book on electrical theater lighting for the architect or stage manager. There are only too few books upon a subject which is unfortunately still regarded as recondite. The illuminating engineer has been so diligent in attacking the problem of house lighting that he has not as yet devoted much attention to stage illumination. Even if he were to do so, it is doubtful if he would succeed very brilliantly; for the illumination of the stage demands a technique of its own and a knowledge not only of electrical engineering, but also of theatrical effects. The author has had a very wide experience which is reflected in every chapter of his book. He discusses not only the effects to be sought, but also the machinery by which the effects are obtained.

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(12994) G. A. asks: As a reader, subscriber and admirer of your valuable paper, I now ask if there is any publication dealing with the contortion of vines. Surely enough they wind from left to right in our hemisphere (going up). Do their twists decrease nearing the equator, and then reverse from left to right to left? A. The twining of plants is treated in the botanies. It is usually the case that the same plant twines in the same direction at all times, but there are said to be plants which twine indifferently in either direction. All plants in our hemisphere do not twine with the sun, or from left to right. The morning glory twines in the opposite direction. It is said that plants in the torrid zone reverse their direction of turning quite frequently. We have no information about this feature of plant life in the southern hemisphere. The phenomenon is called circumnutation.

(12995) E. T. O'H. asks: If a person was at sea at 1,000 feet altitude, how far could he see? A. In the best table we have, the distance to which vision will extend from an altitude of 1,000 feet is given as 33.41 miles.

(12996) S. R. asks: In the new edition of J. Todhunter's "Algebra for the Use of Colleges and Schools," on page 438, is an enunciation of Fermat's Theorem which is as follows: If n be a prime number and N prime to n, then N^{n-1} is a multiple of n. On page 439 of said book, paragraph 716, is a full and complete demonstration of said theorem. In query 12980 of April 18th, 1914, what is called Fermat's Theorem there only bears a small resemblance to the theorem as enunciated by Todhunter and assigned to Fermat, though on further investigation I may change my mind. A. In reply to your letter we would say that Fermat had the habit of writing his observations upon the margins of the pages of the books he was reading, and in this way enunciated a large number of new statements upon many topics in mathematics. The theorem which we quoted is known as Fermat's Greater Theorem, as we stated in our note, and to this and this alone the prize offered refers; it does not refer to any theorem which has already been solved. You will note that the periodical from which we abstracted the conditions is the highest in authority in America, and doubtless the information given is reliable.

(12997) W. R. L. says: I purposely asked that my question be submitted to your astronomer. I was under the impression that it was generally admitted that the earth being carried near hotter suns than ours, or, on the other side of it, being carried into regions remote from large and hot suns, was responsible for these great changes in the heat of the earth. So I put it up to Mr. Astronomer. I can't get away from the idea that some sudden change in temperature must be responsible for the imprisonment of the big animals in the ice in such perfect state of preservation as to have the food recently eaten still intact in the stomach. A. The writer of our reply to your former letter was our astronomer, not the one who prepares the monthly article, but the one who for many years has written all the replies to astronomical queries, so that his opinion is not that of a geologist, but of an astronomer. He would further say that no astronomer holds the view that the earth ever has been nearer to any other or hotter sun than the one around which it now revolves. Nor do astronomers believe that the earth could go near to such a sun and ever return to its orbit around our sun again. On the other hand, geologists have entirely abandoned the theory of sudden catastrophes, such as would catch and imprison a mammoth in the ice with the food in his stomach. He was caught in the ice, to be sure, but just as a climber to-day might be and lose his life with his undigested food in his stomach. Scott's "Geology," page 527, declares the doctrine of Catastrophism to be erroneous. Dana's "Manual of Geology," page 978, says that the elevation of the land in high altitudes is a sufficient cause for the glacial period. He does not even allude to the theory of catastrophes. No geologist or astronomer holds that sudden changes in the earth's climate have ever occurred.

(12998) I. C. McG. asks: Is there a school anywhere where children are taught the "sense of weight," so that they may know how much a pound or two pounds or five pounds are, just by the sense of weight, without having scales for proof? Why not have a grocer's clerk that can size up a package just as exactly as a bank cashier can size up a stranger? The child now is taught many more things than most of them can realize or profit by, but among them are many subjects no more important than the sense of weight. A. We quite agree with you that it is desirable to practise in the estimating of weights, but we do not think any such accuracy can be acquired as in the estimate of length by the eye. It does not seem possible that one can estimate a pound as accurately as a foot. Sensation in the eye is much more acute than the sense of pressure

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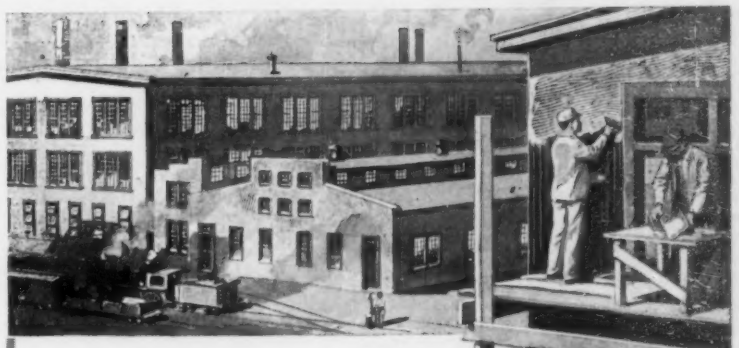

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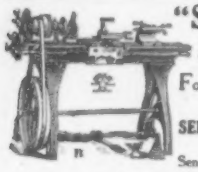

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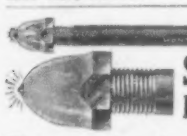

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upon a muscle, or the tension of a muscle. We should prefer the indication of the scales to the judgment of even an honest grocer's clerk in buying butter. There are schools in which weights are enclosed in boxes all of the same size and outward appearance, but the weights differ, and the student is to determine the weight. Such exercises are advantageous in developing the judgment of the student, and should be extended.

(12999) C. H. asks: I wish to ask if you can give me answers to the questions below or tell me in what book I can find them. 1. How can the force against an object exerted by the impingement of a ray of light be calculated, and how measured? A. You will find an abstract of a lecture by Prof. Nichols, who succeeded in measuring the pressure of radiation, in our SUPPLEMENT No. 1539, and other valuable articles upon the same subject in SUPPLEMENT Nos. 1525, 1814 and 1958, which we will send for ten cents each, mailed. 2. Where can I get a radiometer (one of those glass affairs containing a vane-wheel which spins when exposed to light) and what is the cost of one? A. You can buy a radiometer from any dealer in physical apparatus. 3. What books or papers have you for sale on selenium cells and transmission of light? A. We can furnish you with many papers on selenium. We name SUPPLEMENT Nos. 1430, 1719, 1912, 1881, 1882, 1883, 1897, 1914, and the SCIENTIFIC AMERICAN, Vol. 102, No. 8, and Vol. 107, No. 21; price, 10 cents each, mailed.

(13000) F. M. H. asks: Desiring to gain the date of a few modern inventions, I have been recommended to you. Can you give me the date and name of the inventors of the following: Steam power, electricity as a power, telegraphy, the first steam vessel? I would like the date of the first alphabet. A. As a rule, the dates of the "first use" of most things are involved in much obscurity, since no note is taken of such matters at the time. Their importance is not realized by the persons engaged in the events. The history of the steam engine is given in the "Encyclopædia Britannica," vol. 25, page 818, which you may find in your public library. The earliest use of steam for power is described by Hero of Alexandria, about 130 B. C. The first useful steam engine is usually ascribed to Edward Somerset; at least its description, though perhaps not its construction, in 1663. The first commercially successful engine was that of Thomas Savery, patented in 1698, in England. Newcommen followed in 1705, and in 1763 Watt so improved Newcommen's engine as to make it really a different machine, and from Watt the modern steam engine is usually dated. But it was not till 1829 that the locomotive was successfully brought out by George Stephenson, though many competitors were in the field. The early inventors of steam propulsion on the water are given in SCIENTIFIC AMERICAN, vol. 101, No. 13, price ten cents. You will find in that paper cuts and descriptions of the performance of Johnathan Hull's steamboat, 1737. A letter of a correspondent regarding this boat in the SCIENTIFIC AMERICAN, vol. 101, No. 18, which goes to prove that this boat was built and performed real work, should be read. This seems to have been the first steamboat. Between 1780 and 1807, the date of Fulton's "Clermont," there were other steamboats built, in America and Europe, which are pictured in the paper referred to above. You will find these fully described in Thurston's "Growth of the Steam Engine," which we send for $2.50 postpaid. The first practical recording telegraph instrument was that of Morse, in 1835, to whom we also owe the dot and dash alphabet. The first use of electricity for power was when an electromagnet was used to lift a weight, the date of which is not known. It might be claimed that the first time rubbed amber lifted a piece of thin paper, about 600 B. C., should be taken as the proper date for this. The first motors were run by batteries and antedate the invention of the dynamo. Possibly the first electric motor was that of the Abbe Salvatore del Negro in Italy in 1830. Thomas Davenport, a blacksmith of Brandon, Vermont, in 1835 constructed a car which was run by a motor operated by a battery, which was carried on the car. The early efforts in the line of electric railways are given in the "Encyclopædia Britannica," vol. 27, under the caption Traction. Out alphabet is derived from the Greeks, and they are believed to have obtained their letters from the Phœnicians. The date of this is not known.

(13001) L. B. asks: On the night of April 13th, on a farm about ten miles outside Johannesburg, I witnessed a perfect lunar rainbow. It was a dull white in color, and near the original there appeared the lower part of a second bow. As a reader of your paper, I should be glad to know if this phenomenon would appear under similar conditions, i. e., a rain squall beating up from the west and the moon rising in a clear sky in the east, in any part of the world, or whether it was due to the nature of the atmosphere here, as Johannesburg is situated 6,000 feet above sea level. A. Lunar rainbows are not common, nor can they be called very rare. The writer has seen several. They are as you describe, not bright enough to show the colors of the solar rainbow, unless a faint red and yellow. They are sometimes seen at sea, and the altitude of the place would have no influence in their formation.

(13002) H. K. asks: Some years ago, I recall reading an article in the SCIENTIFIC AMERICAN on the processes of metalizing flowers and insects. I am anxious to know the process, and would like to know if you can furnish the formulas and working knowledge, or advise me where I can get it? A. You will find instructions for electroplating flowers and other soft objects in the SCIENTIFIC AMERICAN, vol. 99, No. 22, and in SUPPLEMENT, Nos. 1716 and 1749, price ten cents each, mailed. Fuller instructions are given in Watt's "Electro-Plating," Chapter VI, which we send for $4.50 postpaid.

(13003) R. E. W. asks: Does the moon have any effect on the growth of vegetables? Does it make any difference when potatoes are planted in reference to the moon? I have been told by several successful farmers that the time to plant potatoes was in the dark of the moon. If planted in the light of the moon, they would all grow to tops. Does the moon have any effect on the killing of pigs for pork? Some claim that if killed during a certain time of the moon the meat will all curl up when fried, other times it will not. Does the moon have any effect on the weaning of children or stock? This all sounds very foolish to me, as I can see no connection between the moon and garden stuffs or pigs and children. The moon is there all the time, but the people I talked with were very indignant when I doubted them. A. There is not a shadow of evidence of a scientific nature to show that the moon has the slightest influence on the weather, or the growth of potatoes, or the cooking of pork, or the weaning of stock. When you think of it that thousands of hogs are killed every day in the year, moon or no moon, in the large slaughter houses of the West, it is evident that the packers have no respect for the moon in selecting a day for the killing of hogs. In the other matters of your inquiry, the same is true. Men do not generally look to the moon for portents for planting. They plant when the ground is in the proper condition.

(13004) A. J. deF. asks: In your issue of May 2nd, 1914, page 368, Mr. Henry Norris Russell says, "at a distance of 1,255 astronomical units, or 117 million miles." J. H. Poynting in "The Earth," page 36, says, "Astronomers use as the unit the distance which light travels in one year at the rate of 186,000 miles per second, or 5.8 million million miles." Please set me clear about this. A. Your difficulty as to units in astronomy is easily adjusted. Both Prof. Russell and Prof. Poynting are correct, since they are referring to different units. The "Astronomical Unit" is the mean distance of the earth from the sun, and this is used in expressing distances in the solar system. Its latest determination is 92,877,000 miles. Prof. Young in his "Manual of Astronomy," page 497, says: "The distances of the stars are so enormous that the radius of the earth's orbit, the astronomical unit hitherto employed (meaning by hitherto, in his book thus far) is too small for a convenient measure. It is better, and now usual, to take as the unit of stellar distances the so-called 'light year,' i. e., the distance which light travels in a year." Now referring to Prof. Poynting's book, page 36, it is evident that he is referring only to the unit of the stellar distances, and not to distances within the solar system, with which Prof. Russell was dealing in the article referred to above. We trust this makes the matter clear. We express short distances in feet, longer ones in miles. In just the same way the Astronomical Unit is used for the relatively short distances in the solar system, and the Light Year for the spaces between us and the stars.

(13005) J. M. asks: I wish to know how to keep flowers that are cut from withering so fast. Is there anything that can be put in the water, or some special treatment? A. It has been said that flowers will keep much longer without fading, if a little ammonium chloride is put into the water in which they are placed. The cut ends should be fresh when the flowers are put into the water. An end of a stem which has been seared and dried cannot absorb water, and the flower must fade. It is best to cut the stems off under water and not allow the air to strike them at all. The protoplasm of the plant is very sensitive, and it is upon its power to imbibe water that the life of a plant depends.

(13006) R. W. N. asks: Please let me know what you know about cleaning silver and gold by the use of a small zinc plate to which a strip of tin is attached. I have used this successfully in cleaning silver in a granite pan, but to-day a man informed me that if a person used a pan made of any other metal than zinc, the silver on the ware placed in the vessel to be cleaned, would be removed and deposited on any part in the pan in which the base metal was exposed. For instance, if the enamel happened to be off in some spot, and the iron exposed, it would plate the iron over with silver removed from the silverware; and if a tin vessel was used, if there was a spot where the iron happened to be exposed, the silver would be plated over it and would continue to plate and replate over the silver already deposited thereon, thus removing silver from all silverware placed in such a pan with the zinc plates for cleaning. A. In the use of the silver and gold cleansing process, it is necessary to have a metal dish, or better a metal plate in an earthen dish, which is electro-positive to silver. It is not difficult to find such metals, since silver and gold are negative to most of the metals. Presumably, most of the solutions employed contain nitrate of silver, which is deposited on the silver article by electrolysis, a feeble current being set up in the liquid. Thus a plating action is produced. The list of metals given in the "Standard Electrical Engineers' Handbook," price $4, is as follows: Aluminium, zinc, tin, lead, iron, copper, silver, gold. Any metal which precedes silver may be used, but the farther away from silver the metal is in the list, the stronger the action will be. From this it is seen that aluminium is the best metal to be had for the plate, and zinc is the next in value. It is also to be seen that the plating action would not be reversed by the use of iron or steel in the dish in which the plating is carried on. It is more common to use an earthen dish and to place in it a sheet of aluminium, with which the silver articles are brought into contact.

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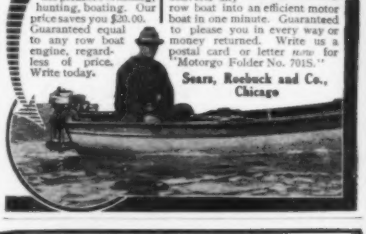

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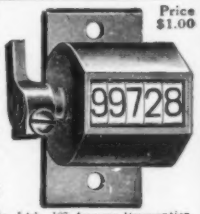

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June

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These are **A FEW,** *a very few*
of the GOOD THINGS

TO BE FOUND IN THE JUNE NUMBER OF

AMERICAN HOMES AND GARDENS

A superbly illustrated, authoritative magazine devoted to the interest of American home-makers, a magazine unsurpassed in the wide field it covers.

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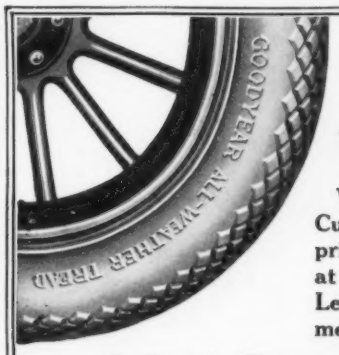


Tire Prices
Which Appear Unjust

When tires cost more than No-Rim-Cut tires, every evidence is that those prices are unjust. Yet 16 makes sell at higher prices—up to one-half higher. Let us tell you why those extra prices mean an utter waste.

No-Rim-Cut Tires In Four Ways Excel

Note first that Goodyears—after millions of tests—hold top place in Tiredom. No other tire ever won so many users. And never before were men changing to Goodyears so fast as they are today. Our this year's increase in tire sales so far is 55 per cent.

And No-Rim-Cut tires have these four features which no price buys in any other tire:

The No-Rim-Cut feature—the only way known to build a satisfactory tire which makes rim-cutting impossible.

Our "On-Air" cure—an extra process which saves the blow-outs due to wrinkled fabric. It adds to our tire cost $1,500 daily.

Our rubber rivets—hundreds of which are formed in each tire during vulcanization, to combat the loose tread danger.

Our All-Weather tread—a tough double-thick tread, as smooth as a plain tread, but grasping wet roads with deep, sharp, resistless grips.

Mark that at no price does any other maker give you one of these features, which together save tire users millions of dollars.

Why We Undersell

Goodyear prices are due to matchless output, to efficient methods and to modest profits. But our tires represent—as our prestige must prove—the utmost in a tire. Plenty of tires offer lesser quality, but none can offer greater.

Any dealer will supply Goodyear tires at Goodyear prices if you tell him that you want them. And you will always use them when you test them once.

GOODYEAR
AKRON, OHIO
No-Rim-Cut Tires
With All-Weather Treads or Smooth

THE GOODYEAR TIRE & RUBBER CO., Akron, O.

Toronto, Canada **London, England** **Mexico City, Mexico**

Dealers Everywhere **Branches and Agencies in 103 Principal Cities.**

Write Us on Anything You Want in Rubber (1571)

OXY-ACETYLENE
Welding and Cutting

THE French torch, with the basic principle of the interchangeable tip employing both acetylene and oxygen under positive pressures, was brought to the United States by the Davis-Bournonville Company in the Spring of 1907. Since securing the French patents about forty other patents have been obtained for improvements and development of Oxy-Acetylene apparatus.

More than $300,000 has been expended in development of apparatus, and the company, from its beginning, has been the acknowledged leader in the industry. It maintains experimental and development as well as commercial welding plants, has expert designers and operators and leads the world in automatic welding and cutting devices. It has made the process available for almost every kind of metal working plant, from the smallest to the largest, for the small repair shop, the garage, machine shop, foundry, railroad shop, ship-building yard and largest steel working concerns. Most effective apparatus for automatically generating acetylene, oxygen and hydrogen gases has been perfected.

Price Reduction

The process or license charge, which has heretofore been necessary to meet the extraordinary cost of experimental work, development and introduction of the new process, has been discontinued, resulting in large price reduction for initial installations of Oxy-Acetylene plants.

DAVIS-BOURNONVILLE CO.
DAVIS
APPARATUS
NEW YORK - CHICAGO

Complete Welding Outfit for $105

A welding outfit of the highest efficiency may now be obtained at this price, including our standard welding torch with five tips, an oxygen regulator with pressure gauges, acetylene reducing valve with pressure gauges, special acetylene and oxygen hose, with necessary couplings and fittings, for use with compressed acetylene and oxygen in portable tanks.

Davis-Bournonville apparatus is extensively employed in all United States Navy Yards, on the Panama Canal and other Government work, in a large number of railroad shops, by a great many of the largest iron and steel, aluminum and brass working industries, in ship building yards, by automobile manufacturers, and for welding steel furniture, steel sash and frames, automobile metal bodies, in hundreds of garages and repair shops throughout the country, and in many foreign countries.

FACTORS OF SUCCESS

Two factors of prime importance are responsible for the success of and with Davis-Bournonville apparatus. First: Efficiency of the equipment, and Second: Competent instruction provided for all purchasers of its equipment.

With the introduction of the new process there was immediate necessity for proper instruction of workmen in a process then unknown to the metal trade. From the first the Davis-Bournonville Company has maintained most successful welding shops for demonstration and development of the process, and for the competent instruction of employes of purchasers.

The service which goes with Davis-Bournonville apparatus is, therefore, one of the greatest elements of the successful operation of its plants.

The company realized the great field offered for Oxy-Acetylene welding and the value the process might have in metal working, and that more than a welding outfit would be required to meet the demands of the larger industrial concerns. The result to-day is an unequaled range of equipment to meet all requirements, combining strength, symmetry, efficiency and convenience in handling. Its torches use 1.14 of Oxygen to 1 of Acetylene, an economy of gases, we believe, acquired by no other type of torch.

AUTOMATIC MACHINERY

The *Oxygraph* is probably most famous. It will cut almost any form, following a drawing on a table, even the initials of a name, in steel up to five or six inches in thickness at a speed of from four to twelve inches per minute.

The *Radiagraph* is an electrically driven three-wheeled truck carrying a cutting torch. It will cut straight lines of any length or circles of any diameter. It has repeatedly cut 16-inch nickel steel armor plate at the rate of four lineal inches per minute.

The *Duograph* is a two-torch machine for barrel and other welding, welding opposite sides of the seam simultaneously. It makes the strongest possible weld with a great saving in labor and gases.

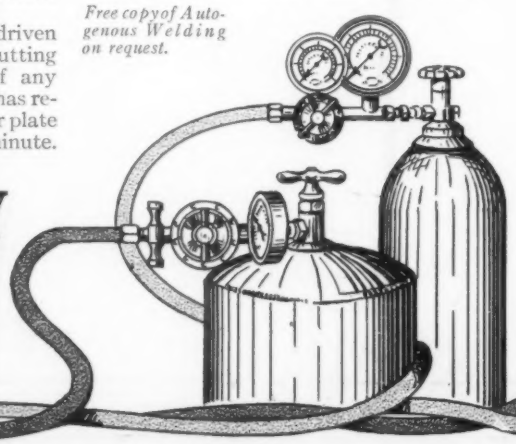
The *Railagraph* is for cutting rails and structural steel.

The *Camograph* follows a cam and cuts the particular form desired.

The *Hologragh* quickly cuts round holes in steel from one-half to two inches in diameter.

The results obtained by this family have been so interesting and revolutionizing that they have been shown in moving pictures all over the world under the name of "The Knife of Fire" and other titles.

Free copy of Autogenous Welding on request.



DAVIS-BOURNONVILLE COMPANY

NEW YORK CHICAGO

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